MBTA SALEM COMMUTER RAIL STATION GARAGE AND STATION IMPROVEMENTS

FINAL SCOPE REPORT

Prepared for:
Massachusetts Bay Transportation Authority

Prepared by:
AECOM

October 20, 2010

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ES Executive Summary

1.0 Background and Scope of Work

The Massachusetts Department of Transportation (MassDOT) is committed to improving the commuter rail station located in Salem, Massachusetts. The station is among the busiest in the system and has limited visibility and accessibility from the city. Additionally, there currently exists a lack of sufficient parking at the Salem Commuter Rail Station, and the Massachusetts Bay Transportation Authority (MBTA) wishes to proceed with plans to increase parking at this site. The MBTA is currently proposing a parking facility that will provide approximately 800 spaces on the MBTA site, an increase of +/- 460 spaces over the existing 344 spaces.

Modes of transportation on the site need to be considered: pedestrians, bicycles, cars, buses, and trains. The design intent is to sufficiently separate the different modes of transportation so that each mode will function safely and properly with minimal interference.

Scope adjustments are being driven by budget and funding. The vehicular and pedestrian bridge connection from Washington Street is no longer part of the base project. The parking count has been reduced to approximately 800 spaces surface and structured. One deck has also been eliminated from the parking structure. Bus bays have been removed from within garage footprint. The height of the first floor of garage has been reduced.

2.0 Project Definition

The MBTA, Commonwealth of Massachusetts, and City of Salem is devoted to transforming the station area into a Salem downtown gateway that will contribute to area revitalization.

Features included as part of this concept design are: full-high platform suitable for 9-car trains, platform canopy connected to buses, waiting room, “pedal and park” bicycle storage, and new accessible ramp from Washington Street intersection to the platform level. Track adjustments are not anticipated as part of the scope. Access from Washington Street will be via existing stairs with a new uncovered accessible ramp.

The parking facility is anticipated to serve patrons of the MBTA commuter rail as well as employees and users of the adjacent court complex.

As currently proposed, the 5-level parking structure will provide approximately 800 spaces with an average of +/- 335 SF per space. A newly designed kiss and ride and taxicab drop off/pick up curb will be located near the train platform.

A site plan, garage deck plans, sections and concept renderings are provided in Section 2.0.

3.0 Traffic Summary

In 2008, the Salem Commuter Rail Station served the third highest number of Boston-bound passengers in the MBTA’s commuter rail system with 2,500 daily boardings.

The project site currently contains a surface parking lot with +/- 344 spaces for commuter rail passengers. The proposed parking garage will replace the MBTA parking lot and have +/- 800 parking spaces on five levels. Adjacent to the site, the City operates a parking lot with 123 surface spaces, providing all-day parking. The City parking lot will not be affected by the proposed MBTA parking garage and will continue to operate independent from the commuter rail lot.

The commuter rail station also serves as a bus stop for nine MBTA bus routes. Bus routings or stops will not be affected by the proposed parking garage. Pedestrian access and amenities will be improved and bicycle parking capacity will be increased.

The current site configuration is classified as level of service (LOS) F; with the traffic generated by the parking garage; traffic exiting the MBTA site is expected to continue to experience LOS F during both the a.m. and p.m. peak hour. Please see additional field traffic counts completed in September 2010 in Section 3.0 Traffic Summary. The current site access/egress is unsignalized; long-term plans for the Bridge Street corridor call for future improvements including signalization at this intersection. While the Bridge Street/site driveway remains unsignalized, the LOS applies to traffic exiting the project site. Bridge Street traffic would continue to operate freely through the intersection.

4.0 Structural Systems

MBTA parking standards incorporate an 8’-6”′ by 18’ parking stall geometry with a 24′ drive-aisle for 90 degree parking. The parking facility is currently designed with a two-way driving pattern and a 90-degree parking stall. The module width is the required 60 feet and the vehicle spacing will meet or exceed the MBTA requirements.

During the development of design concepts, the design team analyzed various options for structural systems with respect to the project criteria. There are multiple variations/combinations of structural systems in use for the construction of parking structures utilizing post-tensioned concrete, pre-tensioned concrete, conventionally reinforced concrete and structural steel sections.

Upon review it is Walker’s opinion that the all pre-tensioned precast concrete system is the appropriate choice for the Salem MBTA project when the four main project criteria of functional design, cost, aesthetics and durability are considered and weighted.

5.0 Proposed Schedule

The project schedule is being developed with the MBTA. Items to be addressed include Construction Procurement Methodology (e.g., Ch149A CMAR), Construction Phasing Alternatives, and Environmental Permitting. At this time, environmental permitting appears to be the “critical path” with respect to design. The draft schedule indicates a duration of approximately 11 months for environmental permitting. Assuming that this effort is initiated in January 2011, construction could commence in November/December 2011.

6.0 Project Costs

Construction cost estimates identify and quantify costs associated with garage and with other elements of the improvements. With the scope adjustments identified in this report, the order of magnitude of construction costs indicated is +/- $24.9 million. The Daedalus Projects’ construction estimate is provided in the appendix. Of this, approximately $18.0 million is associated with the construction of the garage structure. The balance of the construction costs is associated with station improvements, site access, and related amenities. A project budget will be developed based on the construction cost estimate with a total budget target of $30 million. Accordingly, value engineering and cost management will continue to be critical to meeting the budget target.

7.0 Next Steps

In addition to development & documentation of the design, next steps include:

- Environmental Permitting
- Geotechnical Evaluation
- Traffic Analysis (field counts)
- Construction Phasing / Implementation
- Construction Procurement Methodology
- Coordination with future development of rail line row.

8.0 Appendices

- Scope Adjustment Summary, dated September 10, 2010 revised
- Parking Garage Salem, MA: Conceptual Design Estimate Dated August 19, 2010
- Salem MBTA Parking Garage Salem, MA: Conceptual Design Estimate Dated August 19, 2010
- Annual Maintenance Cost New Facility (Design Development Level Service Life Cost Study), dated September 3, 2010.

1.0 Background & Scope of Work

1.1 Introduction

The Salem commuter rail station is located on the edge of the historic downtown of Salem, on the Newburyport/Rockport Line, just south of the turnout at the Beverly Station. The station is located at the end of Washington Street north of Bridge Street and across from the courthouse complex. The grade elevation of the existing MBTA parcel is approximately eighteen feet below the elevation of Bridge Street. The parcel adjacent to the site is owned by the City of Salem and used as surface parking. The MBTA parcel currently provides 344 parking spaces and the City of Salem parcel provides 123 surface parking spaces.

Additionally the triangular site is bounded on two sides by tracks owned by the Guilford Corporation. To the North, the Guilford tracks are active and mostly used as layover space.

The right-of-way adjacent to the south penetrates the site and physically separates the City lot from the MBTA property. Access to the site has one primary vehicular entrance/exit and several pedestrian paths, formal and informal.

The vehicular entrance is located at the south of the site off of Bridge Street. Pedestrian access points are primarily to the south and the west of the site.

The MBTA commuter rail tracks are located to the east of the site. The tracks are accessed from a platform with a mini-high platform at the far end of the station.

The site is also home to a watch tower constructed in 1900. The tower is not part of the proposed project and will remain intact.

1.2 Scope of Work

Scope of work includes analysis of adjustment to previous designs to accommodate approximately 800 cars on the site. Improvements to site amenities, station amenities, and garage program include:

- Provide design for a full-high platform without track adjustments.
- Provide platform canopies and enclosed (heated and cooled) waiting area.
- Provide pedestrian access from Washington Street via existing stairs with a new accessible ramp.
- Provide “pedal and park” bicycle storage adjacent to the waiting area and platform.
- Provide design for 5-level parking facility with single point of entry and exit and integrated Salem station program.

The state has established a working project budget of $30.0 million and this Scope Adjustment Report describes project elements for the site, station, and garage that may be anticipated within such a project budget.

Additional scope items beyond the current project budget could include:

- Provide an area for a +/-2,000sf Registry Express adjacent to the waiting area, proximate to site access from Washington Street.
- Provision of (2) toilet rooms.
- Extended platform canopies.
- Additional brick exterior.
- Future pedestrian and vehicular bridge connections from Washington Street.

1.3 Project Goals

The MBTA, City of Salem, and other stakeholders have identified the following project goals:

- Increase the number of parking spaces on the site from +/- 344 to approximately 800 spaces
- Minimize traffic impacts to surrounding streets and neighborhoods
- Improve handicapped access (pedestrian and vehicular parking)
- Improve access to new full-high train platform
- Improve site amenities (canopy, enclosed waiting area, and communication systems)
- Increase site security via good visibility and lighting
- Minimize scale and visual impact of proposed garage
- Design garage to respect the architectural context of Salem

In addition to the functional requirements of the project, the design team will also take into account that the Salem station serves as a point of entry to the City of Salem. The design is intended to allow visitors to orient themselves when arriving at Salem.

2.0 Project Definition

The MBTA, Commonwealth of Massachusetts, and City of Salem is devoted to transforming the station area into a Salem downtown gateway that will contribute to area revitalization.

2.1 Site Amenities

Site amenities include:

- +/- 2,000 SF enclosed (heated and cooled) waiting area (including stairs and elevator core)
- Canopy system linking the waiting area, garage, bus lanes, and platform
- Access from Washington Street via existing stairs with a new uncovered accessible ramp
- “Pedal and park” bicycle storage

2.2 Station Improvements

Station improvements include:

- Current plans for station improvements include an accessible full-high platform
- Track adjustments are not part of project scope

2.3 Garage Program

Garage program includes:

- +/- 800 spaces with an average of +/-335 SF per space (these numbers will be marginally adjusted as the design is advanced)
- HOV, plug-in, car-share, and accessible spaces have been designated close to vertical circulation
- Single point of entry and exit from the site.
- Functional details remain to be developed but it is anticipated that entry and exit lanes will be flexible to accommodate anticipated peak level activity associated with morning and afternoon commuting patterns.

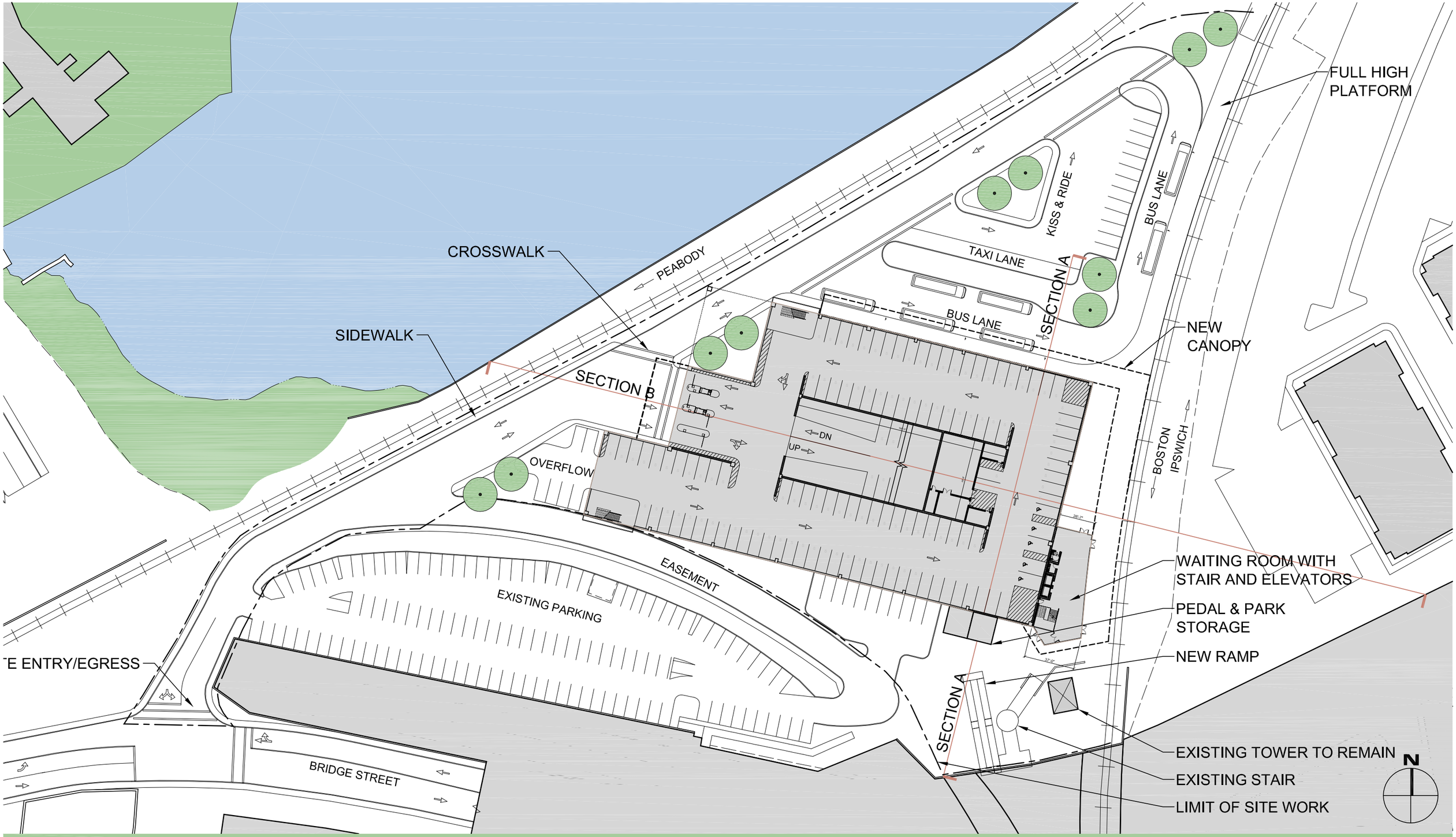
2.4 Scope Adjustments

To address the project budget, scope items have been adjusted from earlier designs including:

- Direct vehicular connection to Washington Street has been removed from the project scope
- Garage structure has been consolidated to 5 levels
- Bus traffic no longer resides within the garage footprint
- Clear height of the first deck (level 2) has been lowered
- Expansion of the upper decks over the access drive
- Limited use of brick toward the platform and Washington Street.

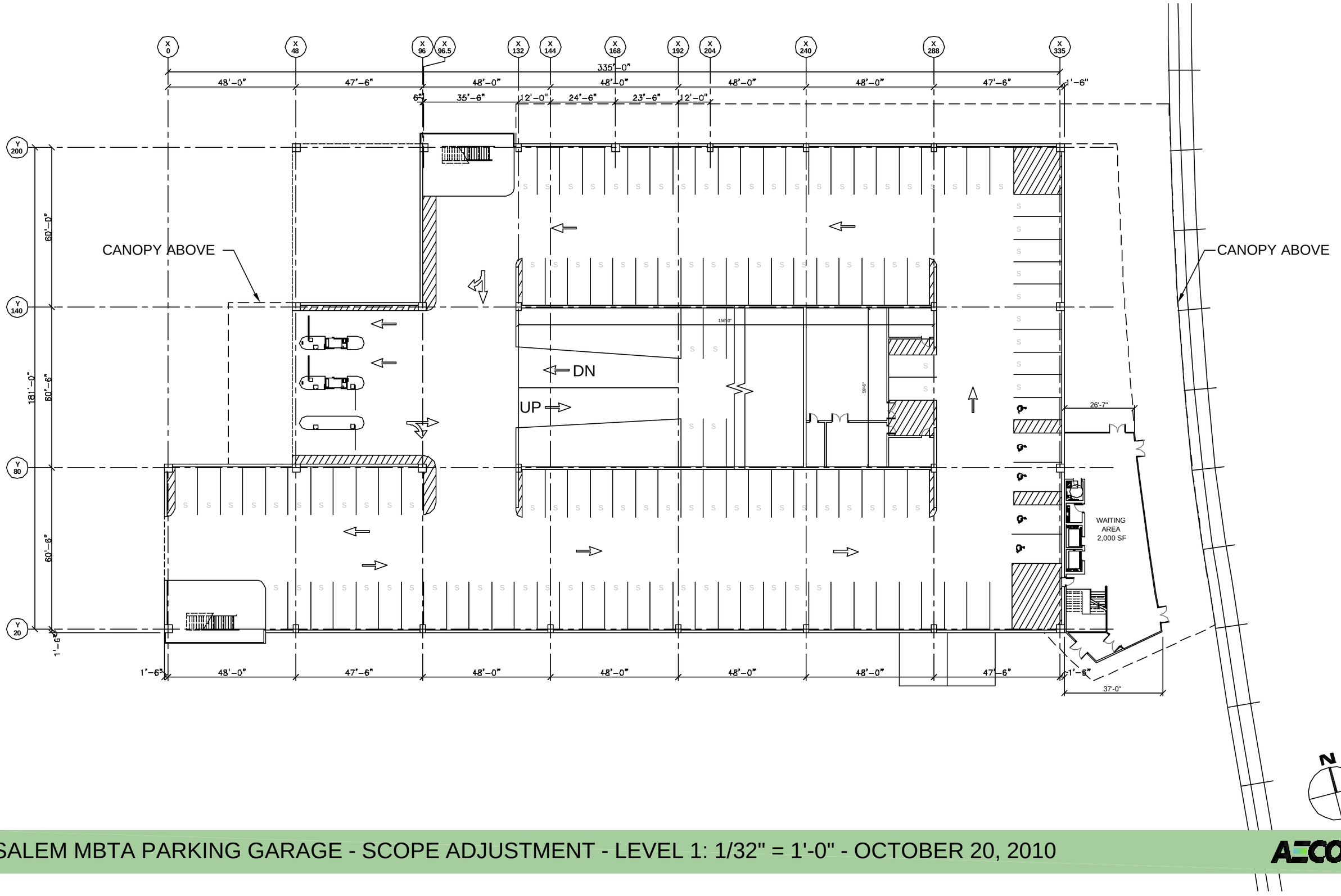
Additional scope items could include:

- Future pedestrian and vehicular connection to Washington Street.
- +/- 2,000 SF Registry Express
- Toilet rooms
- Extended platform canopies to North
- Additional brick exterior



SALEM MBTA PARKING GARAGE - SCOPE ADJUSTMENT - SITE PLAN: 1/64" = 1'-0" - OCTOBER 20, 2010

AECOM



SALEM MBTA PARKING GARAGE - SCOPE ADJUSTMENT - LEVEL 1: 1/32" = 1'-0" - OCTOBER 20, 2010

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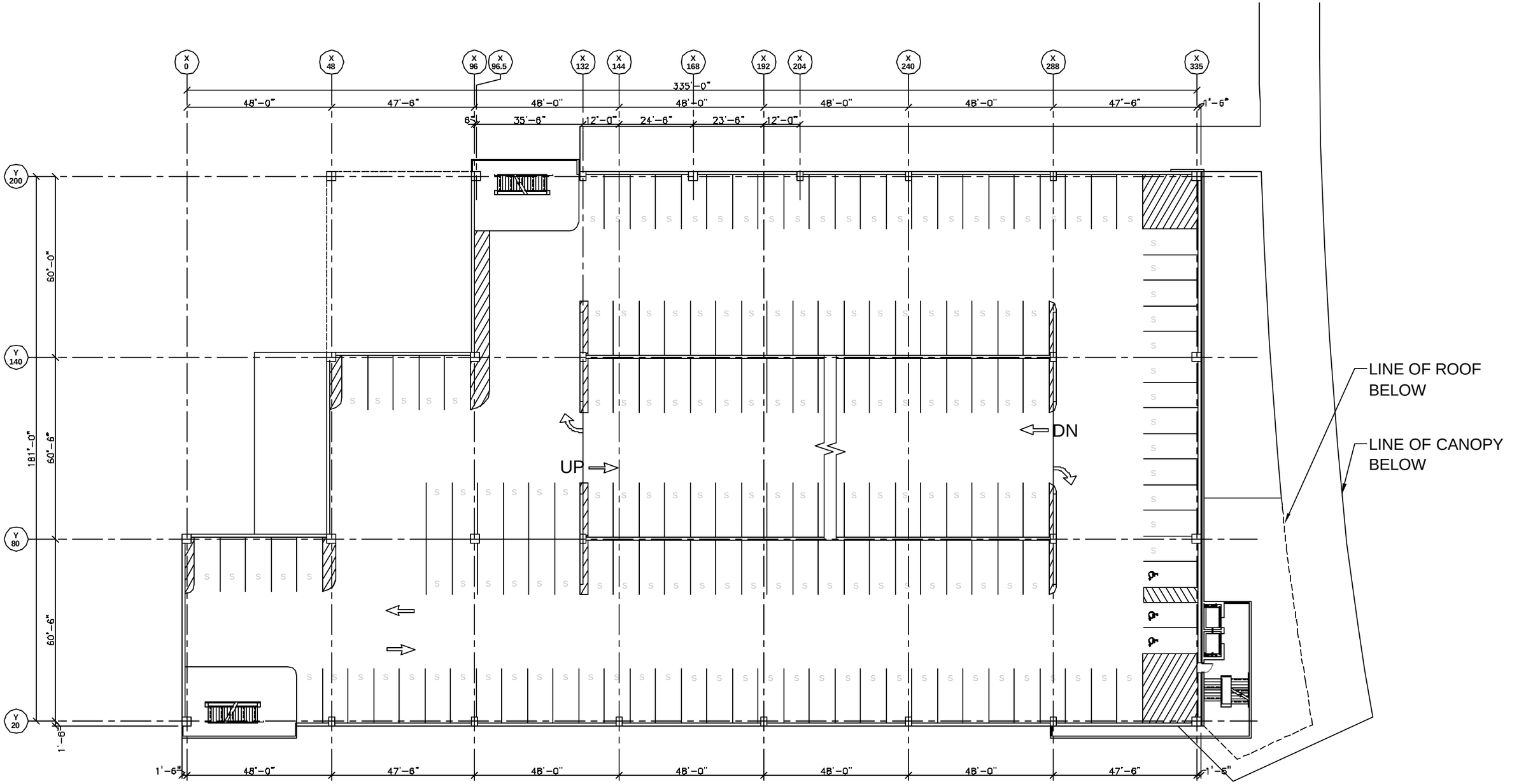

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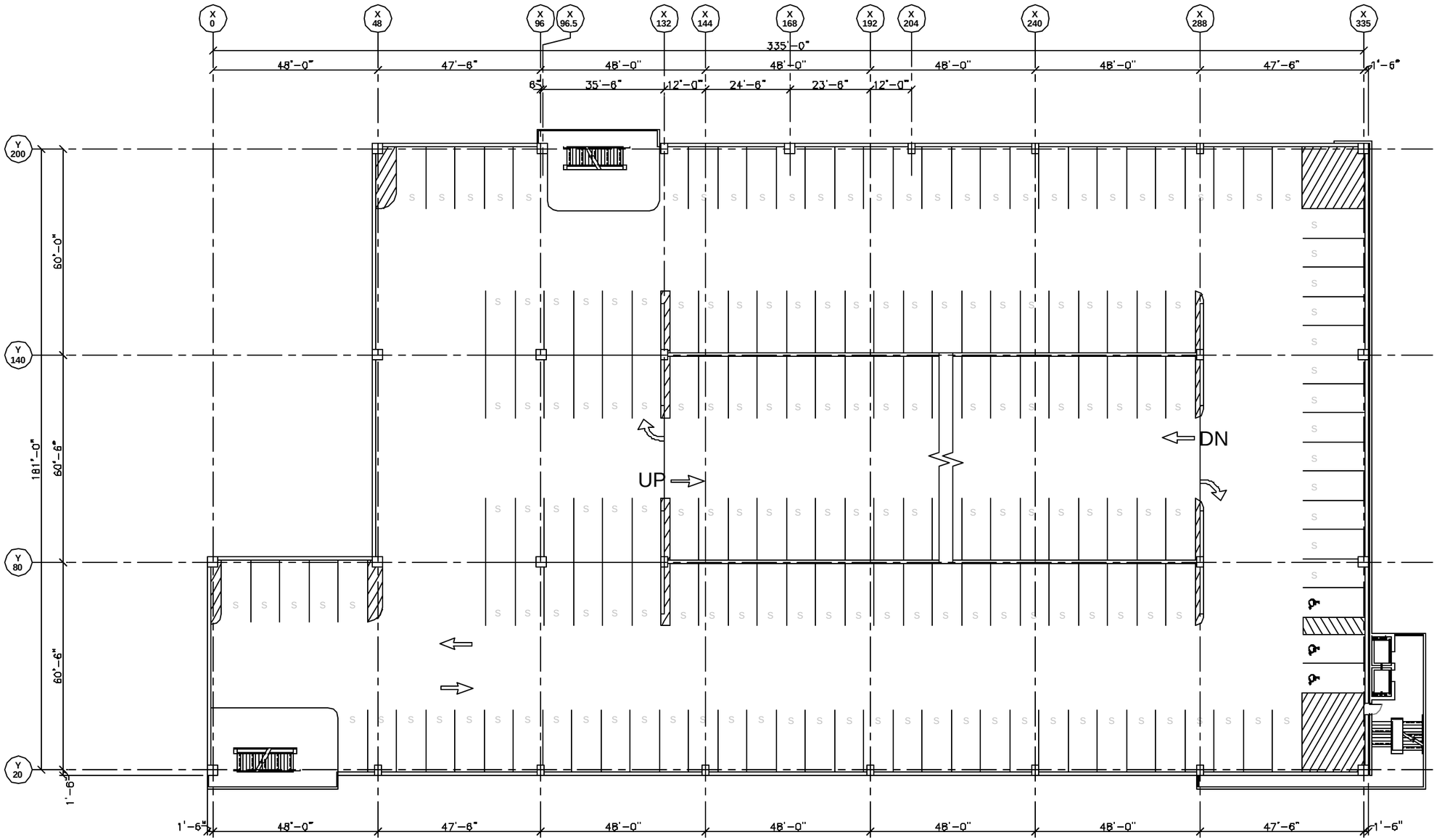

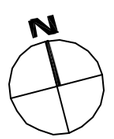

SALEM MBTA PARKING GARAGE - SCOPE ADJUSTMENT - LEVELS 3-4: 1/32" = 1'-0" - OCTOBER 20, 2010

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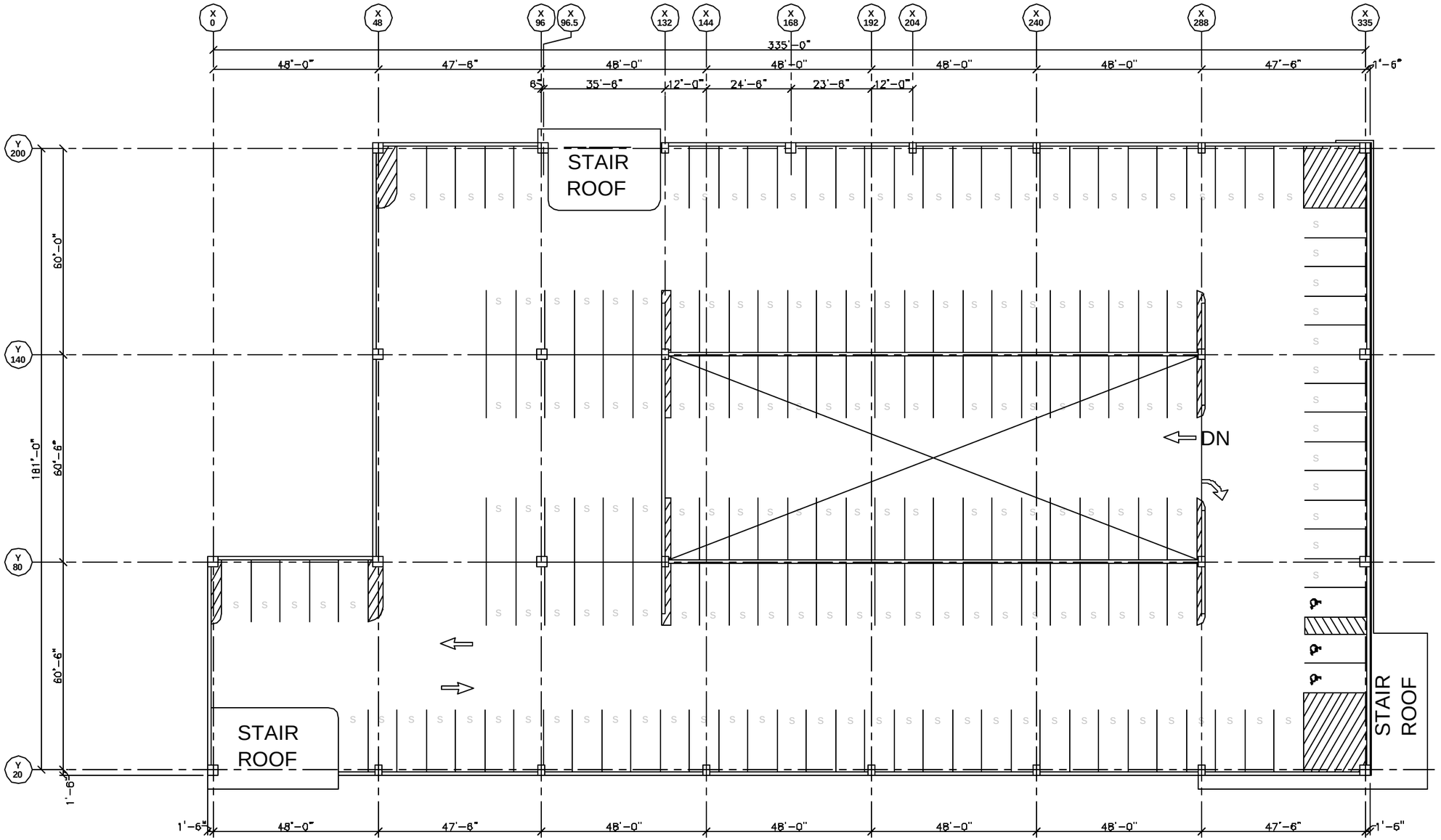
X 0
X 48
X 96
X 96.5
X 132
X 144
X 168
X 192
X 204
X 240
X 288
X 335
335'-0"
48"-0"
47'-6"
48'-0"
48'-0"
48'-0"
48'-0"
47'-6"
1'-6"
6"
35'-6"
12"-0"
24'-6"
23'-6"
12"-0"
Y 200
Y 140
Y 80
Y 20
181'-0"
60'-0"
60'-6"
60'-6"
1'-6"
STAIR ROOF
DN
STAIR ROOF
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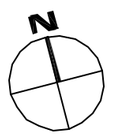
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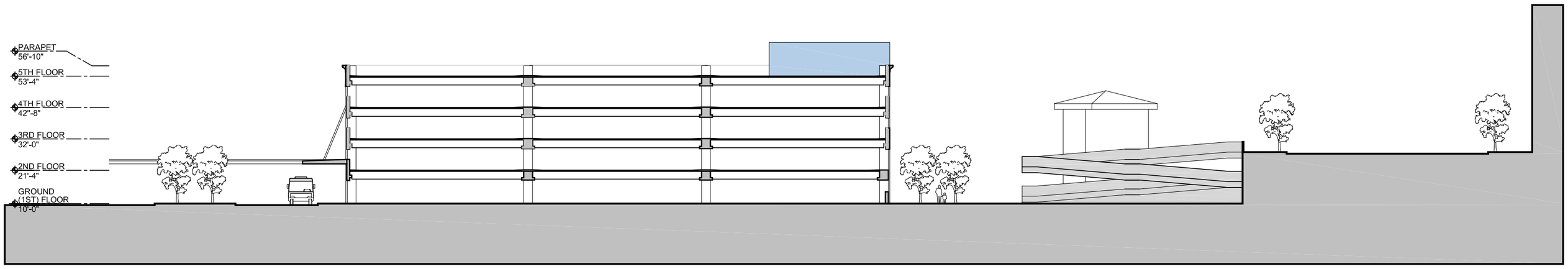
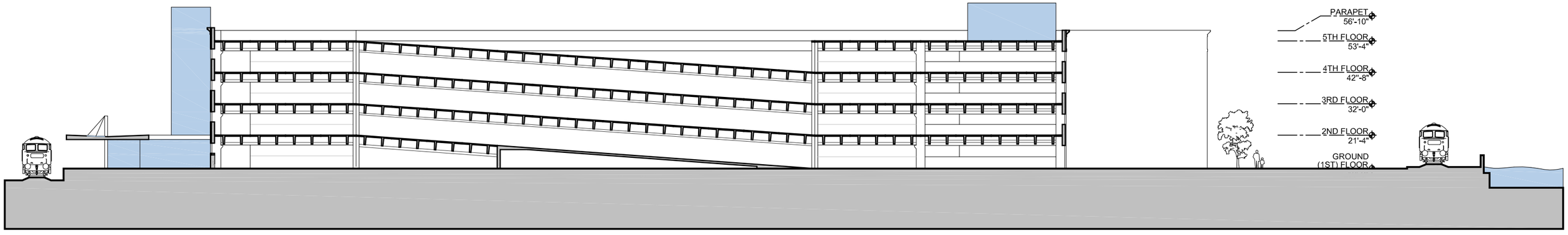
TAXI LANE | BUSWAY | GARAGE | ACCESSIBLE RAMP | BRIDGE STREET



SECTION A

PLATFORM | LOBBY | GARAGE | ROADWAY | FREIGHT | NORTH RIVER



SECTION B

SALEM MBTA PARKING GARAGE - SCOPE ADJUSTMENT - SECTIONS: 1/32" = 1'-0" - OCTOBER 20, 2010

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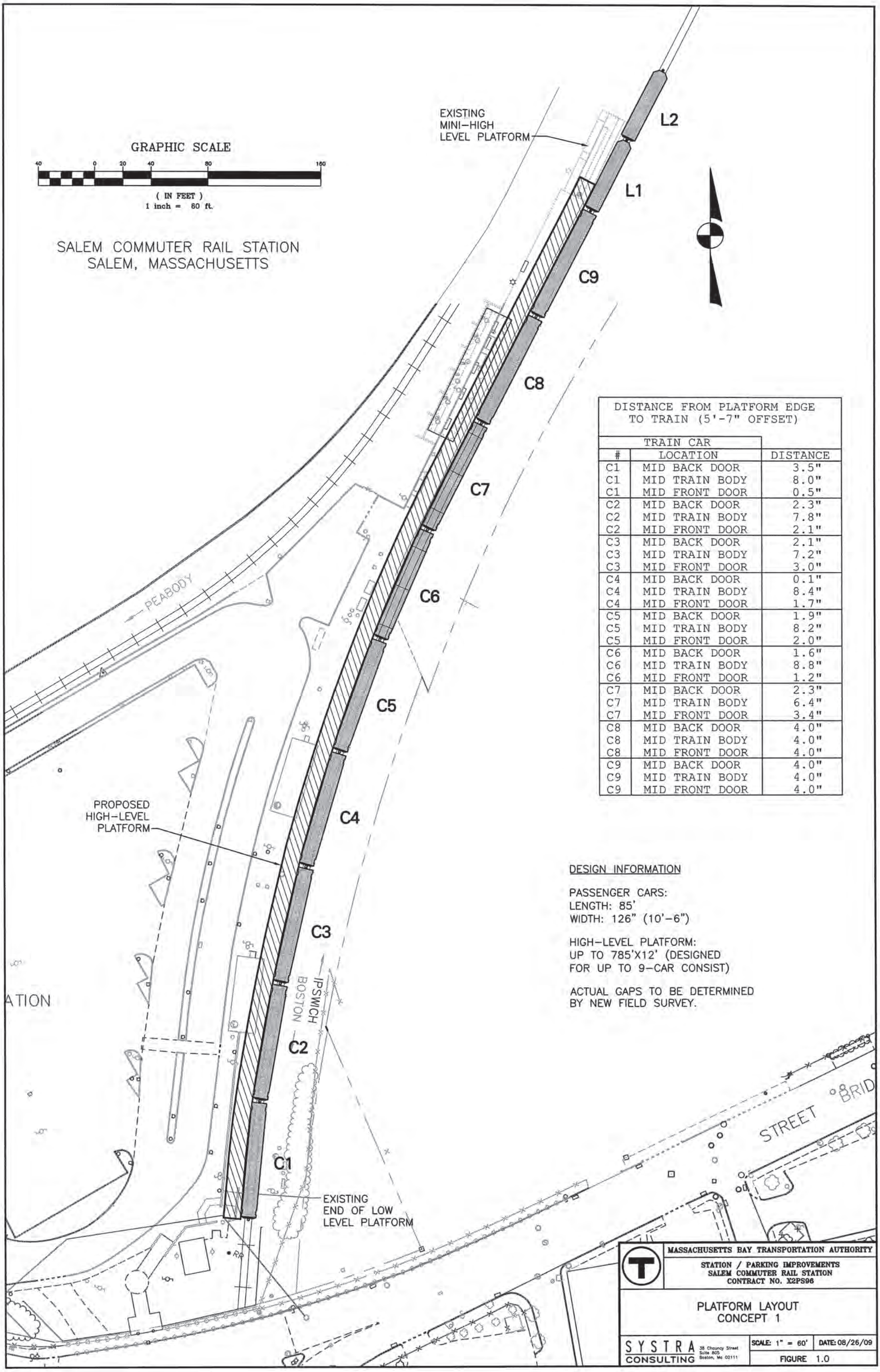


DISTANCE FROM PLATFORM EDGE TO TRAIN (5'-7" OFFSET)		
TRAIN CAR #	LOCATION	DISTANCE
C1	MID BACK DOOR	3.5"
C1	MID TRAIN BODY	8.0"
C1	MID FRONT DOOR	0.5"
C2	MID BACK DOOR	2.3"
C2	MID TRAIN BODY	7.8"
C2	MID FRONT DOOR	2.1"
C3	MID BACK DOOR	2.1"
C3	MID TRAIN BODY	7.2"
C3	MID FRONT DOOR	3.0"
C4	MID BACK DOOR	0.1"
C4	MID TRAIN BODY	8.4"
C4	MID FRONT DOOR	1.7"
C5	MID BACK DOOR	1.9"
C5	MID TRAIN BODY	8.2"
C5	MID FRONT DOOR	2.0"
C6	MID BACK DOOR	1.6"
C6	MID TRAIN BODY	8.8"
C6	MID FRONT DOOR	1.2"
C7	MID BACK DOOR	2.3"
C7	MID TRAIN BODY	6.4"
C7	MID FRONT DOOR	3.4"
C8	MID BACK DOOR	4.0"
C8	MID TRAIN BODY	4.0"
C8	MID FRONT DOOR	4.0"
C9	MID BACK DOOR	4.0"
C9	MID TRAIN BODY	4.0"
C9	MID FRONT DOOR	4.0"

DESIGN INFORMATION

PASSENGER CARS:
LENGTH: 85'
WIDTH: 126" (10'-6")

HIGH-LEVEL PLATFORM:
UP TO 785'X12' (DESIGNED FOR UP TO 9-CAR CONSIST)

ACTUAL GAPS TO BE DETERMINED BY NEW FIELD SURVEY.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

STATION / PARKING IMPROVEMENTS
SALEM COMMUTER RAIL STATION
CONTRACT NO. X2PS96

PLATFORM LAYOUT
CONCEPT 1

SYSTRA CONSULTING 38 Chauncy Street Suite 805 Boston, Ma 02111

SCALE: 1" = 60' | DATE: 08/26/09

FIGURE 1.0

SALEM MBTA PARKING GARAGE - SCOPE ADJUSTMENT - TRACKSIDE RENDERING - OCTOBER 20, 2010

AECOM

SALEM MBTA PARKING GARAGE - SCOPE ADJUSTMENT - AERIAL RENDERING - OCTOBER 20, 2010

AECOM

3.0 Traffic Summary

3.1 Summary

This report presents the traffic and parking impacts associated with the proposed new parking garage at the Massachusetts Bay Transportation Authority's (MBTA) Salem Commuter Rail Station in Salem, Massachusetts. Below is a summary of project site characteristics and major findings from the analysis:

- In 2008, the Salem commuter rail station served the third highest number of Boston-bound passengers in the MBTA's commuter rail system, with 2,500 daily boardings.
- The Project site currently contains a surface parking lot with 340 spaces for commuter rail passengers. The proposed parking garage will replace the MBTA parking lot and have 801 parking spaces on 5 levels, with approximately 650 spaces designated to commuter rail passengers and approximately 150 spaces designated for parkers associated with the J. Michael Ruane Judicial Center, located on nearby Bridge Street.
- The commuter rail station also serves as a bus stop for 9 MBTA bus routes. Bus routings or stops will not be affected by the proposed parking garage.
- Adjacent to the site, the City owns and operates a parking lot with 123 surface spaces, providing all-day parking. The City lot is separate from the MBTA Project site and any future redevelopment of the City lot will occur independent of the new MBTA garage. In the short-term, it is anticipated that the City parking lot will continue to operate as it does today.
- Vehicle access to the new parking garage (and City lot) will continue to be via the Bridge Street/MBTA Driveway intersection.
- A newly designed kiss-and-ride and taxicab drop-off/pick-up curb will be located near the train platform.
- Pedestrian access and amenities will be improved and bicycle parking capacity will be increased.
- The only site driveway to the MBTA parking lot, commuter rail station, and City parking lot is located at the unsignalized intersection of Bridge Street/MBTA Driveway. Based on 2010 traffic counts, drivers exiting the MBTA Driveway currently experience level of service (LOS) F during the a.m. and p.m. peak hours.
- In September 2010, the peak hours of traffic at the Bridge Street/MBTA Driveway intersection were 7:15 a.m.–8:15 a.m. and 5:00 p.m.–6:00 p.m., corresponding to the peak times of commuter arrivals and departures, respectively, at the station.
- In 2008, as part of the Ruane Judicial Center project, the roadways ramps in the southeast quadrant of the North Street/Bridge Street interchange were removed and the ramps in the southwest quadrant were reconfigured to accommodate the displaced traffic movements. A comparison of peak-hour traffic counts at the Bridge Street/MBTA Driveway intersection taken in 2006 and 2010 show that while the overall volumes have decreased by about 7%, the distribution pattern at the MBTA Driveway has changed, with more vehicles arriving and departing via the western leg of Bridge Street and fewer via the eastern leg. This change is directly due to the ramp reconfiguration at North Street.
- Under Build conditions, with the increased traffic generated by the parking garage, traffic exiting the MBTA Driveway will continue to experience LOS F during both the a.m. and p.m. peak hour. It should be noted that if the Bridge Street/MBTA Driveway remains unsignalized, the poor level of service and delays only affect traffic exiting the Project site and the left turn from eastbound Bridge Street into the site. Through traffic on Bridge Street would continue to operate freely through the intersection.
- The Bridge Street/MBTA Driveway intersection was analyzed with a traffic signal independent of the adjacent signalized intersections of Bridge Street/Washington Street (to the east) and Bridge Street/North Street ramps (to the west). In reality, traffic progression between these closely-spaced intersections is exceedingly important in order to prevent queues from backing up from one intersection into the other.
- Installation of a traffic signal at the Bridge Street/MBTA Driveway would reduce delays and queues for vehicles exiting the MBTA Driveway, but would also cause Bridge Street traffic to stop for a red signal. With a signal, the overall intersection would operate at LOS E during the a.m. peak hour and LOS D during the p.m. peak.
- A traffic signal at the Bridge Street/MBTA Driveway would allow for controlled pedestrian crossings from the Ruane Judicial Center, across Bridge Street, and into the project site.
- The possibility of a traffic signal at the Bridge Street/MBTA Driveway must be assessed relative to the Bridge Street arterial and the nearby traffic signals at the North Street ramps and Washington Street.
- The project team will continue to coordinate with MassDOT on the Bridge Street reconstruction project, which will widen Bridge Street from 2 lanes to 4 lanes between Flint Street and the North Street interchange ramps. Construction is slated to begin in 2012.

3.2 Introduction

This report describes traffic conditions related to the proposed new parking garage at the MBTA's Salem Commuter Rail Station in Salem, Massachusetts, including discussion of the following:

- Existing roadway and traffic conditions;
- Changes in parking activity due to the increased parking capacity; and
- Analysis of the parking garage's impact on traffic operations.

Project Description

The Project site currently contains a surface parking lot with 340 spaces for commuter rail passengers and serves as a bus stop for 9 MBTA bus routes. All vehicles enter and exit the Project site via the unsignalized intersection of Bridge Street/MBTA Driveway.

As shown in the site plan in Error! Reference source not found.**,** the existing lot will be replaced with a 5-level garage containing 801 parking spaces. Approximately 650 spaces will be designated as commuter rail passenger parking and approximately 150 spaces designated for parkers associated with the J. Michael Ruane Judicial Center, located on nearby Bridge Street. In total, the new garage will provide an additional 310 on-site parking spaces for commuter rail riders. It is anticipated that the increased parking capacity will be used by current rail passengers who are unable to find parking at the existing site.

As shown in Error! Reference source not found. an at-grade taxi lane and kiss-and-ride drop-off/pick-up area will be provided near the train platform. Bus routes will continue to have designated stops along the bus-only curb.

Adjacent to the site, the City operates a parking lot with 123 surface spaces, providing all-day parking. The City parking lot will continue to operate independently of the MBTA parking garage and not be affected by the proposed parking garage.

This intersection of Bridge Street/MBTA Driveway will continue to serve as the Project site's sole access/egress driveway when the new garage is complete.

Study Area

As shown in Error! Reference source not found., the Project site is bounded by the MBTA commuter rail tracks on the east, the City parking lot and active railroad tracks to the south, the North River to the north and elevated Route 114/North Street to the west. Across Bridge Street to the south is the newly constructed J. Michael Ruane Judicial Center to be opened in 2011.

This report presents traffic impacts at the intersection of Bridge Street/MBTA Driveway.

3.3 Existing Conditions

Existing Site

The Project site is located on Bridge Street, which runs roughly parallel to the North River and connects the City of Beverly from the north to the City of Salem. To the northeast of the site, Bridge Street intersects with the newly constructed Bridge Street Bypass. The Bridge Street Bypass is separated from the local street network and allows motorists coming to and from the Essex Bridge (which carries Route 1A between Salem and Beverly) direct access from Route 1A to the Project site. Bridge Street is classified by MassDOT as an urban arterial west of Washington Street and as a primary arterial east of Washington Street.

Vehicular access to the Project site is only at 1 location, via the intersection of Bridge Street/MBTA Driveway. Vehicles arriving from North Street (Route 114) or Washington Street need to turn onto Bridge Street to reach the MBTA Driveway. Bridge Street runs underneath the North Street viaduct and the intersection of Bridge Street/MBTA Driveway is located underneath the North Street Northbound Ramp overpass, limiting visibility at the intersection itself.

After accessing the Project site via the MBTA Driveway, vehicles may continue on the Driveway or turn right onto a secondary roadway which allows access to the MBTA Parking Lot and a municipal parking lot owned by the City of Salem. Buses proceed into a bus-only zone.

Existing Roadway and Intersection Conditions

The Project site driveway at Bridge Street/MBTA Driveway is the sole intersection evaluated in this report. Bridge Street runs east-west underneath the North Street viaduct and the intersection with the MBTA Driveway is located immediately east of the viaduct. While this unsignalized intersection does not have any stop control, the MBTA Driveway traffic stops and waits for an acceptable gap in Bridge Street traffic. The westbound Bridge Street approach has 1 travel lane for through traffic and, because Bridge Street widens at the MBTA Driveway, a short (about 50-foot) unmarked right-turn lane for traffic turning into the Project site. Eastbound Bridge Street runs under the North Street viaduct and has 1 through travel lane and 1 left-turn bay for traffic turning into the MBTA Driveway. While the southbound MBTA Driveway approach has one marked travel lane for left and right turns onto Bridge Street, it flares at Bridge Street allowing 1 or 2 right-turning vehicles to proceed while left-turning traffic is queued. Parking is prohibited on both sides of this section of Bridge Street and along the MBTA Driveway.

Existing Traffic

Intersection counts at Bridge Street/MBTA Driveway were collected on September 14, 2010. Two automatic traffic recorders collected data on Bridge Street on September 14, 2010 and on the MBTA driveway between September 21–24, 2010.

Volumes

Traffic flow peaked at this intersection during the morning (7:15 a.m.–8:15 a.m.) and evening (5:00 p.m.–6:00 p.m.) roughly corresponding with the arrival of commuters taking morning trains to Boston and the departure of commuters returning to Salem on evening trains. Activity was limited during the midday peak period as most parkers are still at work and the facility has filled by 8:00 a.m. Intersections volumes are shown in **Figure 2** and **Figure 3** for the a.m. and p.m. peak hour, respectively.

An automatic traffic recorder (ATR) is a device that continuously records the passage and speed of vehicles on a roadway for a given period of time. The average daily volume along Bridge Street is approximately 21,500 vehicles per day. The existing 2-way hourly volumes on Bridge Street are shown graphically in **Figure 4**. Traffic on Bridge Street peaks at about 2,000 vehicles during the morning peak hour and decreases steadily to about 1,200 vehicles per hour between 9:00 a.m.–1:00 p.m. After 1:00 p.m. volumes rise to about 1,600 vehicles due to after school and commuter activity. From 6:00 p.m.–12:00 a.m., volumes steadily decrease from 1,400 to 200 vehicles per hour.

The existing average daily volume along the MBTA Driveway is about 3,100 vehicles per day. The 2-way hourly volumes on MBTA Driveway are shown graphically in **Figure 5**. Traffic volumes on the Driveway are the highest, at about 500 vehicles per hour during the morning peak hour. Volumes remain steady at about 50 vehicles per hour between 9:00 a.m.–3:00 p.m. until outbound commuter trains arrive from Boston and volumes peak at about 400 vehicles per hour at 5:00 p.m. and steadily decline thereafter.

Intersection Operations

The criterion for evaluating traffic operations is level of service (LOS), which is determined by assessing average delay incurred by vehicles at intersections and along intersection approaches. The study team calculated average delay and associated LOS at study area intersections using Trafficware's Synchro 6 software, which also evaluates the impact on traffic operations from closely spaced intersections. This software is based on the traffic operational analysis methodology of the Transportation Research Board's 2000 *Highway Capacity Manual* (HCM).

Level of service and delay (in seconds) are determined based on intersection geometry and available traffic data for each intersection. **Table 1** summarizes the delay and LOS thresholds for signalized and unsignalized intersections, as defined in the HCM. LOS A defines the most favorable condition, with minimum traffic delay. LOS F represents the worst condition (unacceptable), with significant traffic delay. The threshold at LOS E/LOS F indicates that the intersection, or intersection approach, is theoretically at capacity. LOS D is generally considered acceptable in an urban environment, such as the study area near the Salem Commuter Rail Station, and below theoretical operating capacity.

Table 1. Intersection Level of Service Criteria

	Average Stopped Delay (sec/veh.)	
Level of Service	Signalized Intersection	Unsignalized Intersection
A	≤10	≤10
B	>10 and ≤20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	> 80	> 50

The existing Level of Service results for the Bridge Street/MBTA Driveway are presented in **Table 2** and **Table 3** for the a.m. and p.m. peak hour, respectively. The eastbound left turn from Bridge Street into the MBTA Driveway operates at LOS C in the a.m. peak hour and LOS B in the p.m. peak hour. During the a.m. peak hour, the 95th percentile queue for the eastbound left turn is about three to four vehicles (68 feet). The associated left-turn bay has storage capacity of about 80 feet and is, therefore, adequate for the existing demand.

Traffic exiting the MBTA Driveway experiences LOS F during each peak hour with long delays and queues. Results are not reported for Bridge Street traffic because it flows through the intersection without stopping. While delays, volume to capacity (v/c) ratios, and 95th percentile queue lengths are reported in **Table 2** and **Table 3**, it should be noted that once LOS F is reached, the associated measures lose sensitivity and indicate only that congested conditions exist. As such, the associated delays, v/c ratios and queue lengths should not be strictly interpreted. Although the exiting MBTA Driveway volumes are lower in the morning than in the afternoon, the conflicting volumes on Bridge Street are higher in the morning, causing longer delays for MBTA Driveway exiting traffic.

Table 2. Existing Conditions (2010) Level of Service, a.m. peak hour

Intersection	LOS	Delay (seconds)	V/C Ratio	95th percentile queue (feet)
Unsignalized Intersections				
Bridge Street/MBTA Driveway				
Bridge Street EB left	C	15.1	0.49	68
MBTA Driveway SB left/right	F 1)	NA	4.67	NA

Table 3. Existing Conditions (2010) Level of Service, p.m. peak hour

Intersection	LOS	Delay (seconds)	V/C Ratio	95th percentile queue (feet)
Unsignalized Intersections				
Bridge Street/MBTA Driveway				
Bridge Street EB left	B	10.3	0.12	10
MBTA Driveway SB left/right	F 1)	437	1.83	593

1. When LOS F is reached, the associated measures lose sensitivity and indicate only that congested conditions exist. As such, the delays, v/c ratios and queue lengths associated with LOS F should not be strictly interpreted.

Between 4:30 p.m.–6:30 p.m., as trains arrive from Boston and parkers exit the lots, the queue along the MBTA Driveway can grow to 25 vehicles as drivers wait to turn onto Bridge Street. After 5–10 minutes, this queue eventually dissipates. During this 2-hour period, there are 8 outbound trains from Boston stopping at Salem, generally arriving every 15 minutes.

Existing Parking

The Project site currently contains a surface parking lot with 340 spaces for commuter rail passengers. Adjacent to the site, the City operates a parking lot with 123 surface spaces, providing all-day parking. While the City lot is used primarily by MBTA commuters, it appears to serve some local employees who park all day. There are 9 designated accessible parking spaces provided: 6 in the area adjacent to the train platform and 3 in the MBTA parcel.

The MBTA currently charges $4.00 per day for parking and the City charges $2.00 per day in the adjacent lot. The lower parking fee does cause the City lot to fill up at a faster rate than the MBTA lot, but the fact that all spaces in the City lot are farther from the station platform than those at the MBTA lot seems to temper the fill rate. During weekday observations in September 2010, by 8:00 a.m. the City lot was 100% full and the MBTA lot was at 94% capacity. At 3:00 p.m., the City lot remained 100% full and the MBTA lot was 97% full. In the late afternoon, with the arrival of outbound trains from Boston, both parking lots steadily empty from 4:00 p.m. until about 6:30 p.m. When a major sporting event or concert occurs in Boston, some fans park and take the train into Boston. This use generally does not conflict with commuter parking activity, because fans typically arrive late afternoon as commuters are leaving.

In addition to the MBTA lot and City lot, there are approximately 75 informal parking spaces located along the northern side of Bridge Street between the North Street ramps and Lynn Street. This narrow strip of land, about 800 feet long, is bounded by Bridge Street to the south and railroad tracks to the north. Because these spaces are free, they fill up at a faster rate than either the MBTA lot or City lot. In September 2010, these informal spaces were used by both MBTA commuters and construction workers at the Ruane Judicial Center.

A license plate survey was conducted at the MBTA parking lot on September 10, 2003 in order to determine the origins of the parked vehicles and the pick-up/drop-off vehicles. This survey found that Salem residents account for just under half of all parkers and generate 59% of the pick-up/drop-off activity. After Salem residents, the parking areas served primarily commuters from the west, particularly Danvers and Peabody, which accounted for 31% of total parking and pick-up/drop-off activity. Origins from Beverly accounted for only 2% of parkers, primarily because there are 5 commuter rail stations in Beverly. While this data was collected 7 years ago (2003), the pattern of parker origins has likely not changed significantly.

Existing Transit

According to the 2009 Ridership and Service Statistics published by the MBTA (Blue Book), 64 inbound and outbound trains run between Boston and Salem Station on weekdays, traveling on 1 of 2 commuter rail lines: Newburyport or Rockport. Trains run about once every 15 minutes during peak times and about once every hour during off-peak times. Stations serviced on this commuter rail inbound from Salem to North Station are as follows: Swampscott, Lynn, River Works, and Chelsea. Trip duration between Salem and North Station is 25–30 minutes.

The MBTA currently provides 9 bus routes from the site: the 450, 450W, 451, 455, 455W, 456, 459, 465, and 468. Bus access to the site is the same as for other motor vehicles. All buses enter the Project site by turning right from Bridge Street westbound and exit the site by turning right onto Bridge Street westbound.

Existing Pedestrian and Bicycle Facilities

There are currently 4 pedestrian access routes to the Project site. A sidewalk under the North Street ramp provides access to the southwest area of the Project site at the Bridge Street/MBTA Driveway intersection. There is a staircase to the station from the Bridge Street/Washington Street intersection. There is also a handicapped-accessible ramp system to the site west of the Bridge Street/Washington Street intersection. An unpaved path connects a private parking lot west of the North Street viaduct to the southwest area of the Project site. Within the Project site, pedestrian access to the train platform is provided from the Washington Street area and the MBTA Driveway. As part of the recent signalization and reconstruction of the Bridge Street/Washington Street intersection, there are new crosswalks and pedestrian signals on each roadway approach.

Parking for about 35 bicycles is provided by racks in the north section of the site, near the train platform. Passengers are generally permitted to bring bicycles on the MBTA commuter rail in the off-peak direction and during off-peak hours. Bicycles are permitted at all times on weekends. On September 14, 2010, 36 bicycles were parked both in the racks and chained to the fence, indicating that bicycle commuting is commonplace at Salem Station.

3.4 Future Conditions

For transportation impact analyses, it is standard practice to evaluate 2 future conditions: a No-Build Condition (without the proposed project) and a Build Condition (if the project is built). Typically, these conditions are projected to a future date 5 years from the Existing Conditions year. For this evaluation of Project site, the Year 2015 was designated as the future year. Based on previous studies, a background growth factor of 1% was applied to develop Year 2015 No-Build volumes.

Year 2015 No-Build Conditions

The 2014 Future Conditions analysis for both the No-Build and the Build scenarios uses the methodology described in the Existing Conditions analysis. Future No-Build traffic volumes appear in **Figure 6** and **Figure 7** for the a.m. and p.m. peak hours, respectively. The resulting intersection operations results are shown in **Table 3** and **Table 4**.

As under Existing Conditions, the exiting traffic from the MBTA Driveway will operate poorly at LOS F under No-Build Conditions during the a.m. and p.m. peak hour. The eastbound left turn from Bridge Street would operate at LOS C in the a.m. peak hour and LOS B during the p.m. peak hour.

Table 4. No-Build Conditions (2015) Level of Service, a.m. peak hour

Intersection	LOS	Delay (seconds)	V/C Ratio	95th percentile queue (feet)
Unsignalized				
Bridge Street/MBTA Driveway				
Bridge Street EB left	C	15.8	0.51	72
MBTA Driveway SB left/right	F 1)	NA	5.45	NA

Table 5. No-Build Conditions (2015) Level of Service, p.m. peak hour

Intersection	LOS	Delay (seconds)	V/C Ratio	95th percentile queue (feet)
Unsignalized				
Bridge Street/MBTA Driveway				
Bridge Street EB left	B	10.5	0.12	11
MBTA Driveway SB left/right	F 1)	529.9	2.03	639

1. When LOS F is reached, the associated measures lose sensitivity and indicate only that congested conditions exist. As such, the delays, v/c ratios and queue lengths associated with LOS F should not be strictly interpreted.
95th percentile volume exceeds capacity, queue may be longer.

Year 2015 Build Traffic Conditions

For Build Conditions, the traffic activity associated with the new parking garage is added to that under No-Build Conditions.

Parking Activity

As shown in the site plan in Error! Reference source not found., the existing lot will be replaced with a 5-level garage containing 801 parking spaces. Approximately 650 spaces will be designated to commuter rail passengers and approximately 150 spaces designated for parkers associated with the J. Michael Ruane Judicial Center, located on nearby Bridge Street. In total, the new garage will provide an additional 310 on-site parking spaces for commuter rail riders.

It is anticipated that the increased parking capacity will be used by current rail passengers who are unable to find parking at the existing site and either choose to park elsewhere or use some other travel mode to the station, such as walking or biking.
In 2001, the MBTA conducted a ridership survey of North Shore commuters, including passengers at Salem Station. The arrival mode share percentages observed in 2001 (average across all stations) were applied to the current Salem boardings of 2,500 daily passengers to estimate how current passengers are arriving at the Salem Station.
Table 6 shows the number of passengers estimated for each of 4 mode share groups (as described in the table) and the associated Project site parking demand for the existing lot and future garage.
It is anticipated that the additional parking capacity will be used by passengers who switch from Group 2, Kiss-and-Ride, and from Group 3, those who currently park elsewhere.
A reduction in the number of kiss-and-ride passengers reduces the number of daily vehicle trips because pick-up/drop-off activity generates twice as many trips, as compared to on-site parking activity. Providing more parking capacity for passengers who currently park elsewhere does not create new vehicle trips in the study area, but does increase the number of trips arriving at the Project site.
Currently, the on-site parking is filled by 8:00 a.m. on a typical weekday. It is possible that with the increased on-site parking capacity, passengers will have the flexibility of arriving later and still being able to secure a space. If this occurs, it is possible that the number of commuters who take trains after 8:00 a.m. would increase. The MBTA will monitor ridership and evaluate the need for train schedule changes.

In addition to the 650 spaces reserved for MBTA passengers, 150 spaces will be designated for employees and/or visitors to the Ruane Judicial Center. The peak hours of traffic along Bridge Street and at the MBTA Driveway are 7:15-8:15 a.m. and 5:00-6:00 p.m. The Courthouse will be open 8:00 a.m. to 4:30 p.m., with specific courts starting at 8:00 or 8:30 a.m. The courts usually end by 4:30 p.m. During the a.m. peak hour, it has been assumed that half of the 150 court reserved spaces will fill up. No court parking activity was included in the p.m. peak hour.

Table 6. Parking Demand at MBTA Salem Station

Mode Share Group		Daily Inbound Boardings at Station		Vehicles Parked at Peak Accumulation	
Current	Future	Percent of Total	Number	Existing MBTA Parking Lot	Future MBTA Parking Garage
Group 1 Park at MBTA Lot	Park at MBTA Garage	16%	408	340	340
Group 2 Kiss-and-Ride: Dropped off a.m. and picked up p.m.	Continue to be dropped off	9%	175	0	0
	Park at MBTA Garage	5%	175	0	145
Group 3 Park elsewhere	Continue to park elsewhere	26%	654	0	0
	Park at MBTA Garage	6%	138	0	165
Group 4 Use other mode of arrival (walk, bus, bike)	Continue to use other mode	38%	950	0	0
	Park at MBTA Garage	0%	0	0	0
Total		100%	2,500	340	650

Mode share percentages are based on Project site observations and 2001 MBTA North Share Commuter Rail Survey, including an auto occupancy of 1.2 passengers per vehicle. Assumptions applied to current Salem Station Boston-bound boardings of 2,500 daily passengers.

Traffic Volumes

Based on the travel characteristics of the mode share groups presented in **Table 6**, the associated change in traffic volumes with the new garage was calculated for the Bridge Street/MBTA Driveway intersection. Future Build traffic volumes appear in **Figure 8** and **Figure 9,** for the a.m. and p.m. peak hours, respectively, and the associated intersection level of service are shown in **Table 7** and **Table 8.**

With the increased trips generated to the garage in the a.m. peak hour, the eastbound left turn will operate at LOS E while exiting traffic continues to operate at LOS F. During the pm. peak hour, exiting traffic will increase and continue to experience LOS F. The eastbound left turn into the Project site will operate at LOS B.

As a preliminary step to understanding if signalization may reduce delays for traffic exiting the MBTA site, without causing undo congestion along Bridge Street, the Bridge Street/MBTA Driveway intersection was analyzed with signalization. This intersection would operate at overall LOS E during the a.m. peak hour and LOS D during the p.m. peak hour.

Table 7. Future Build Conditions (2015) Level of Service, a.m. peak hour

Intersection	LOS	Delay (seconds)	V/C Ratio	95th percentile queue (feet)
Unsignalized				
Bridge Street/MBTA Driveway				
Bridge Street EB left	E	42.1	0.90	276
MBTA Driveway SB left/right	F	NA	26.1	NA
Signalized				
Bridge Street/MBTA Driveway	E	77.9	1.10	
Bridge Street EB left	F	120.2	1.12	#430
Bridge Street EB thru	A	3.5	0.63	323
Bridge Street WB thru/right	F	124.2	1.20	#1136
MBTA Driveway SB left/right	D	51.2	0.36	55

Table 8. Future Build Conditions (2015) Level of Service, p.m. peak hour

Intersection	LOS	Delay (seconds)	V/C Ratio	95th percentile queue (feet)
Unsignalized				
Bridge Street/MBTA Driveway				
Bridge Street EB left	B	10.1	0.06	5
MBTA Driveway SB left/right	F [1)]	NA	3.26	NA
Signalized				
Bridge Street/MBTA Driveway	D	37.3	0.97	
Bridge Street EB left	E	75.4	0.73	#71
Bridge Street EB thru	B	18.1	0.80	525
Bridge Street WB thru/right	D	41.5	0.97	#745
MBTA Driveway SB left/right	E	55.8	0.95	#340

1. When LOS F is reached, the associated measures lose sensitivity and indicate only that congested conditions exist. As such, the delays, v/c ratios and queue lengths associated with LOS F should not be strictly interpreted.
2. # 95th percentile volume exceeds capacity, queue may be longer.

For this preliminary analysis, the intersection was considered independent of the signalized intersections of Bridge Street/Washington Street (to the east) and Bridge Street/North Street ramps (to the west). In reality, traffic progression between these closely-spaced intersections is

exceedingly important in order to prevent queues from backing up from one intersection into the other. Evaluating traffic operations and progression at the additional Bridge Street intersections is beyond the scope of this current study but is necessary to understanding how traffic along the Bridge Street corridor will operate.

At midday, traffic volumes into and out of the MBTA Driveway are relatively low, about 50 vehicles per hour. Vehicle loop detectors embedded in the MBTA Driveway and the eastbound Bridge Street left-turn bay would be installed to sense vehicles, allowing Bridge Street traffic to flow freely during off-peak periods.

Bus Routes

As shown in **Figure 1**, buses serving the Project site will continue to have a bus-only zone and designated bus stops near the station platform. No bus routings will be modified.

Pedestrian and Bicycles

The current pedestrian access will not change with the proposed facility, but additional amenities will be added to improve accessibility. Pedestrians destined to the trains and buses from the upper Washington Street level will no longer need to use the existing ramp system; instead they can enter the new garage on an upper from the Bridge Street/Washington Street intersection and use an elevator to reach the train platform and bus stops.

Increased use of bicycles can be encouraged by adding bicycle racks at the platform and providing cover over some or all racks.

Figure 1. Site Plan

N

Figure 2. Existing Conditions (2010) Traffic Volumes, a.m. Peak Hour (7:15–8:15 a.m.)

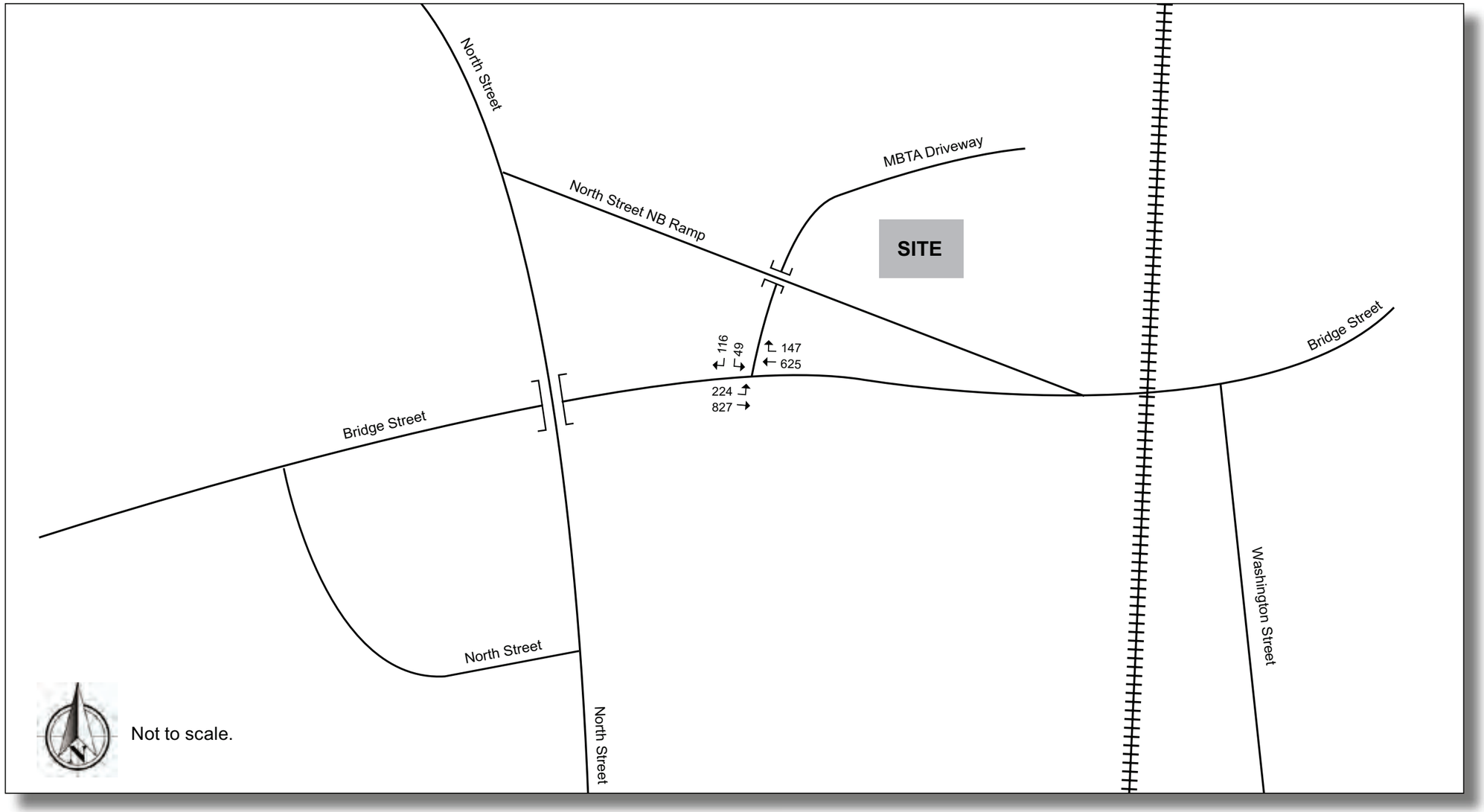


Figure 3. Existing Conditions (2010) Traffic Volumes, p.m. Peak Hour (5:00–6:00 p.m.)

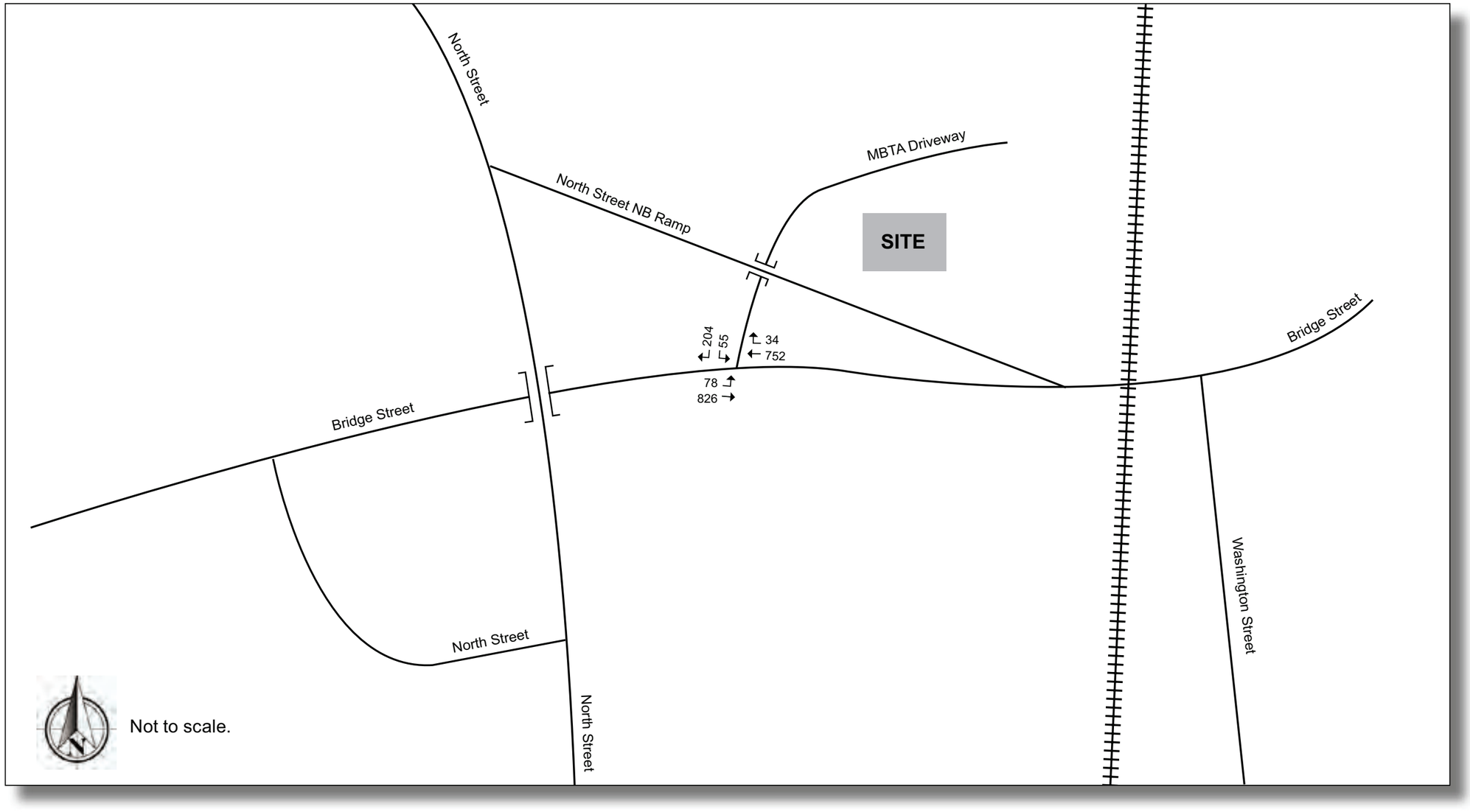


Figure 4. Average Daily Traffic by Hour by Direction
Bridge Street, East of MBTA Driveway

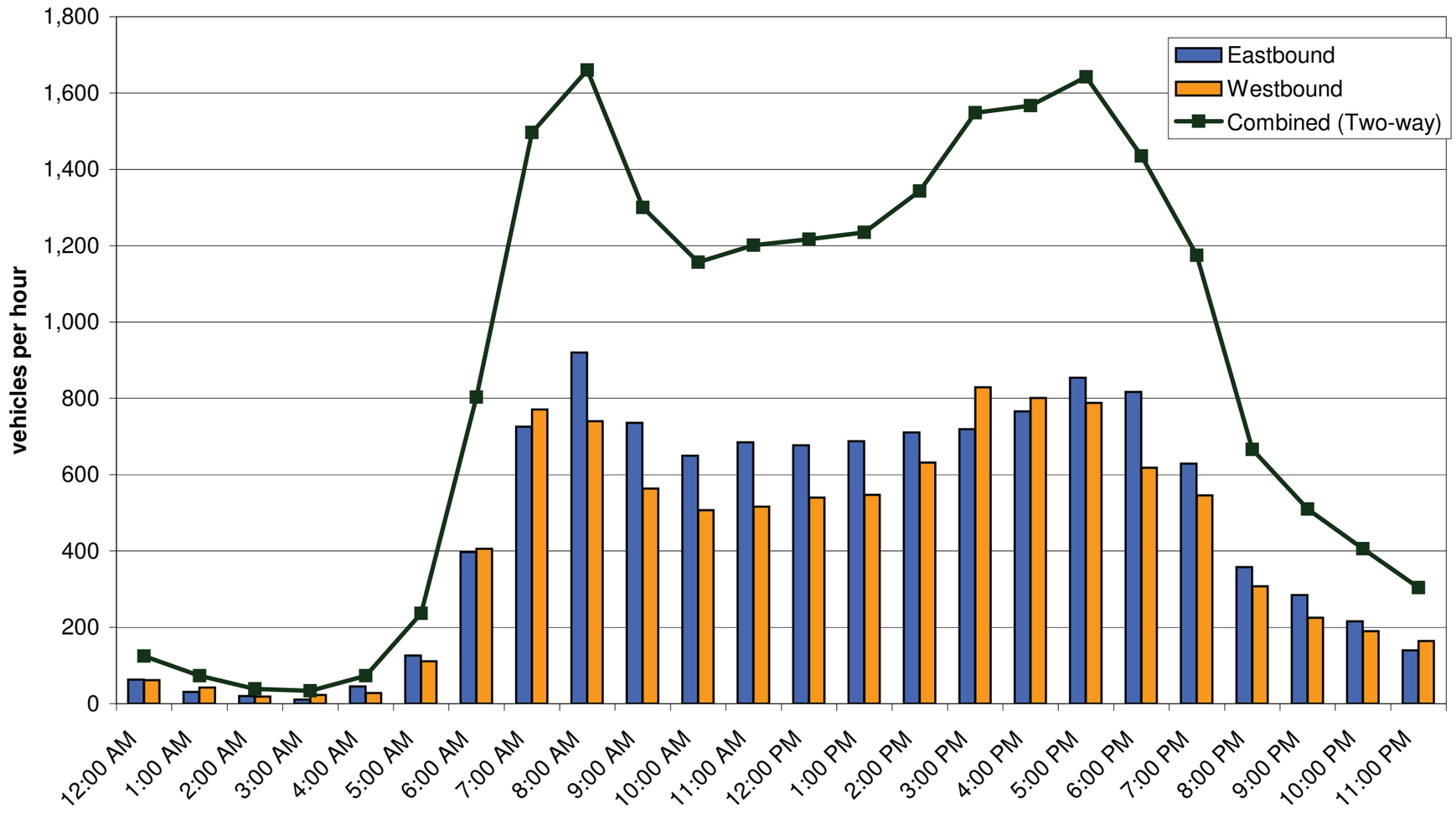


Figure 5. Average Daily Traffic by Hour by Direction

MBTA Driveway, North of Bridge Street

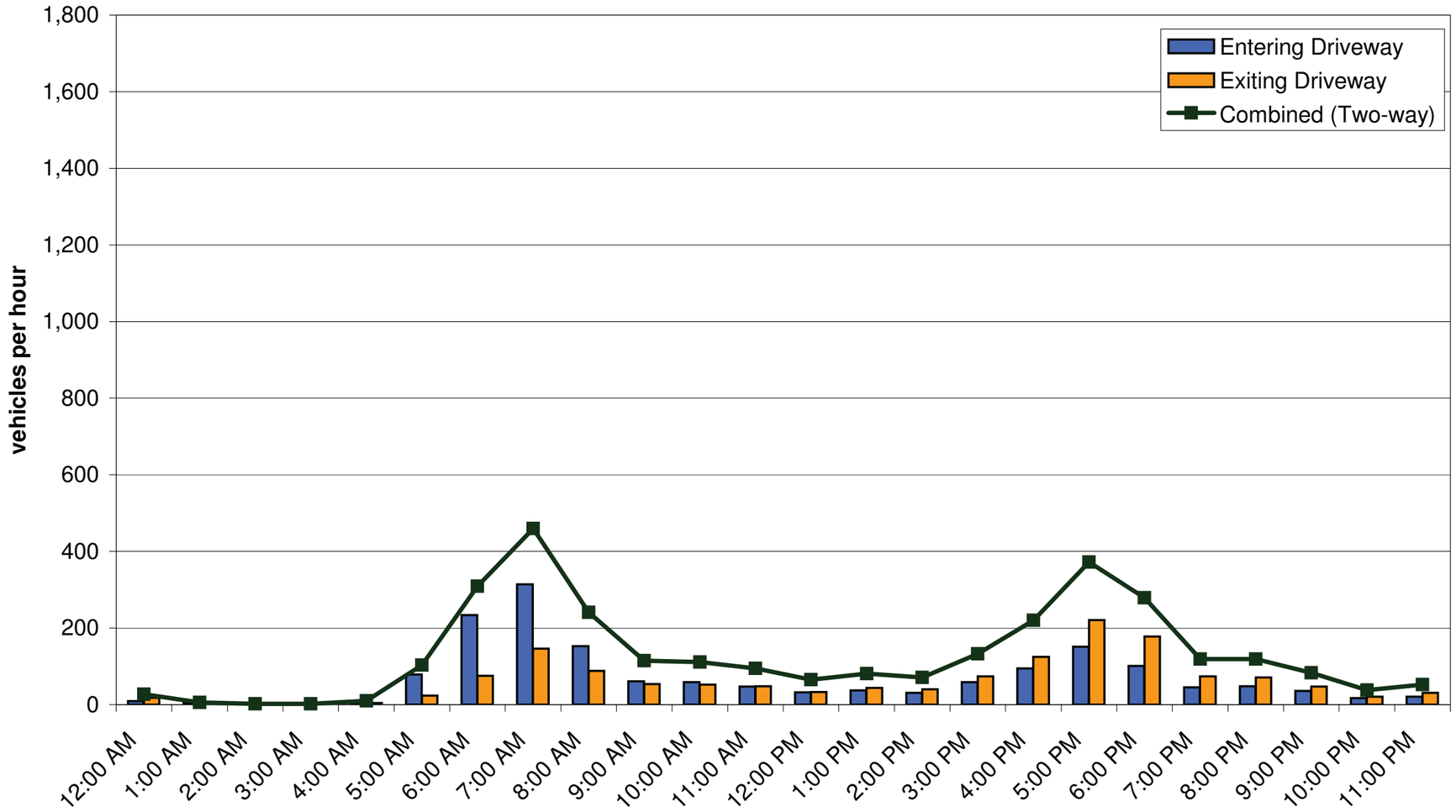


Figure 6. No-Build Conditions (2015) Traffic Volumes, a.m. Peak Hour (7:15–8:15 a.m.)

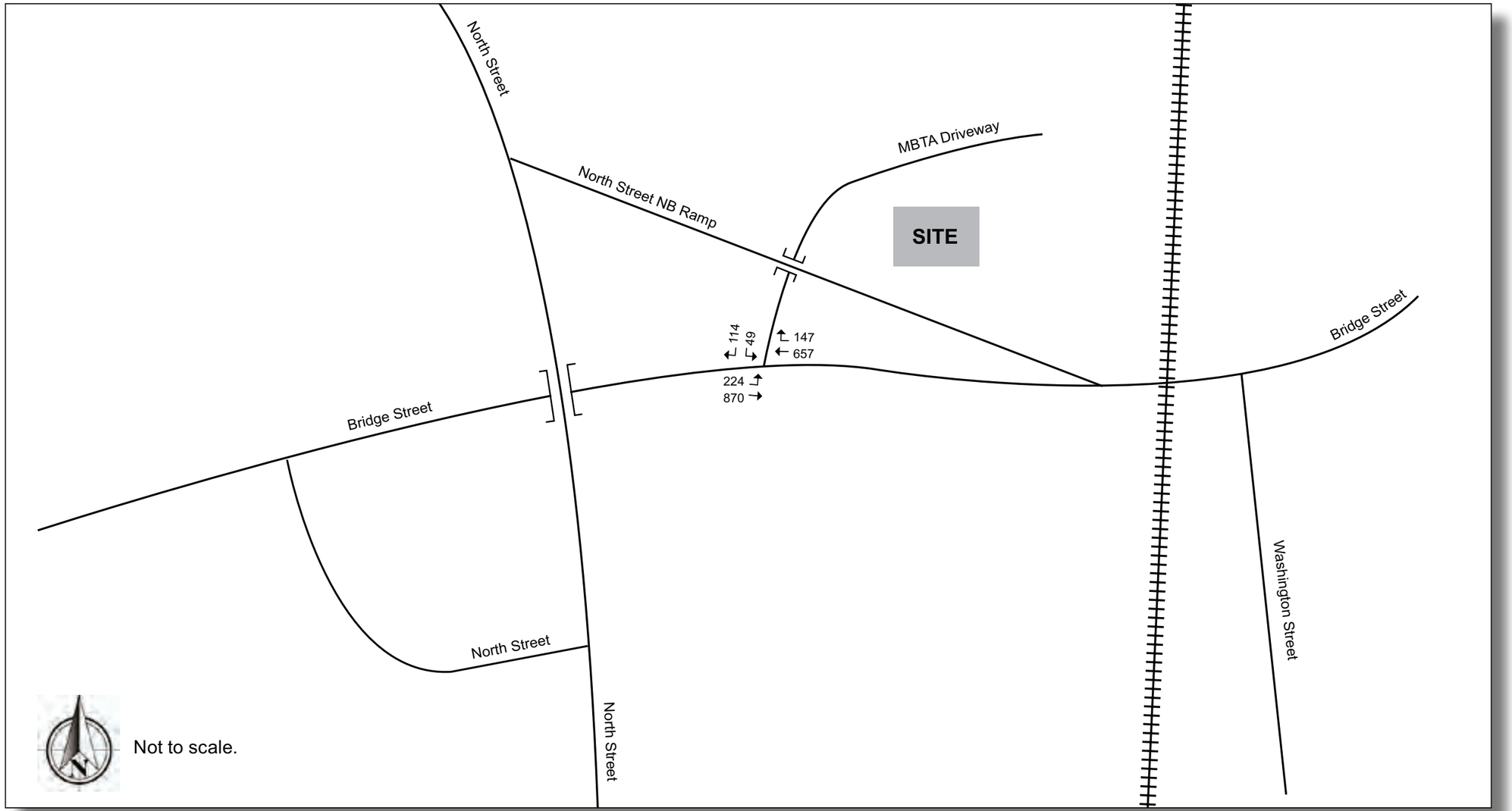


Figure 7. No-Build Conditions (2015) Traffic Volumes, p.m. Peak Hour (5:00–6:00 p.m.)

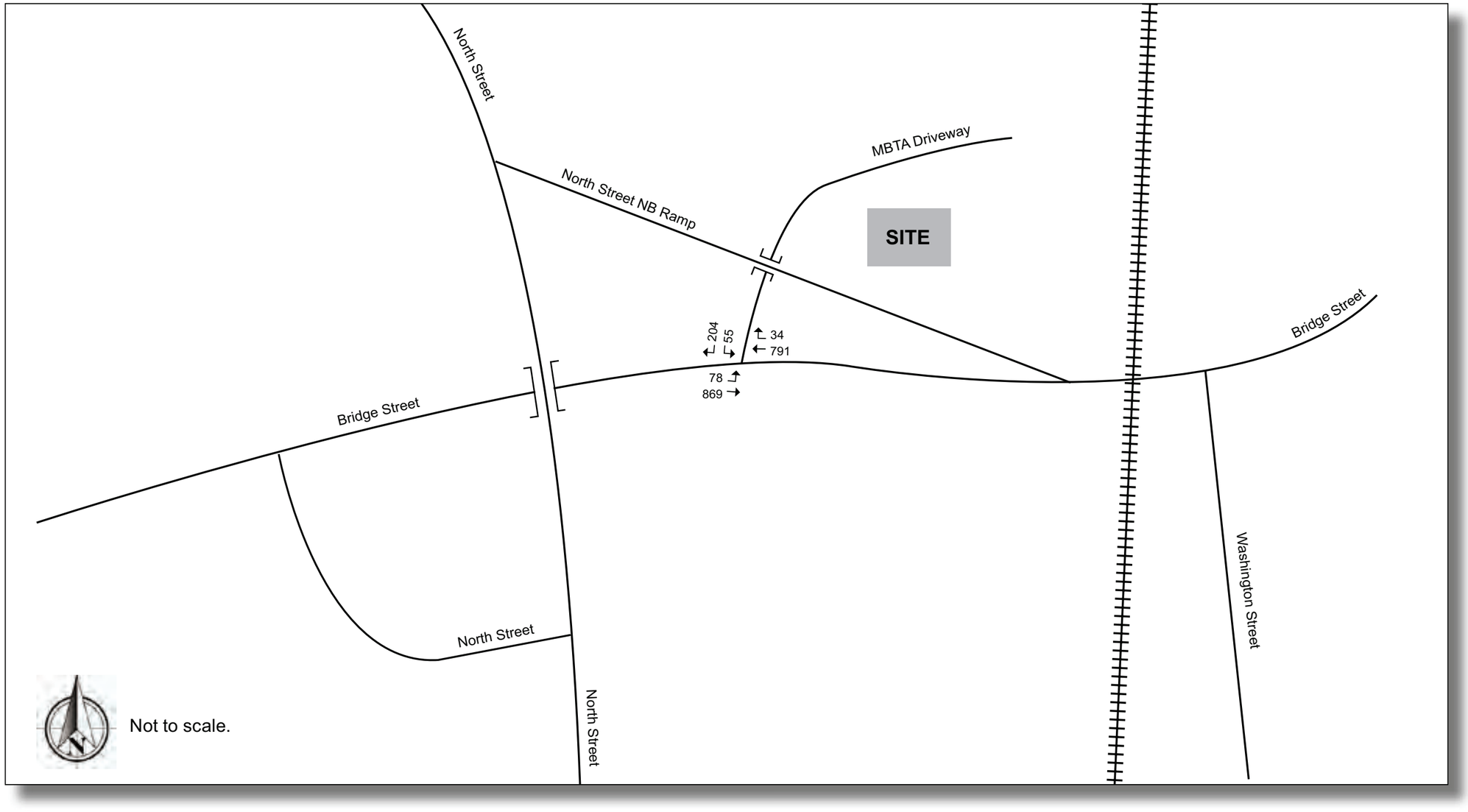


Figure 8. Build Conditions (2015) Traffic Volumes, a.m. Peak Hour (7:15–8:15 a.m.)

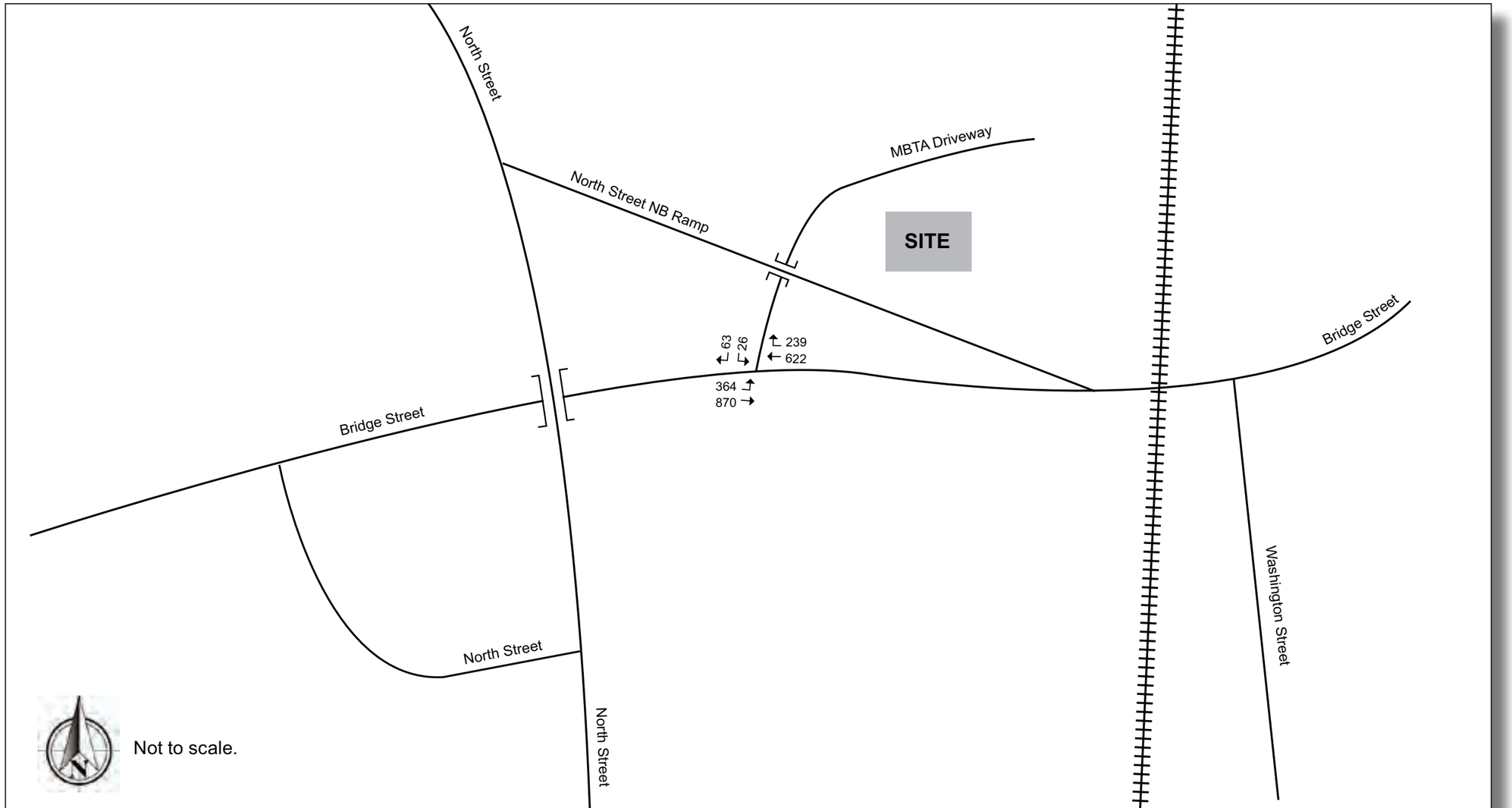
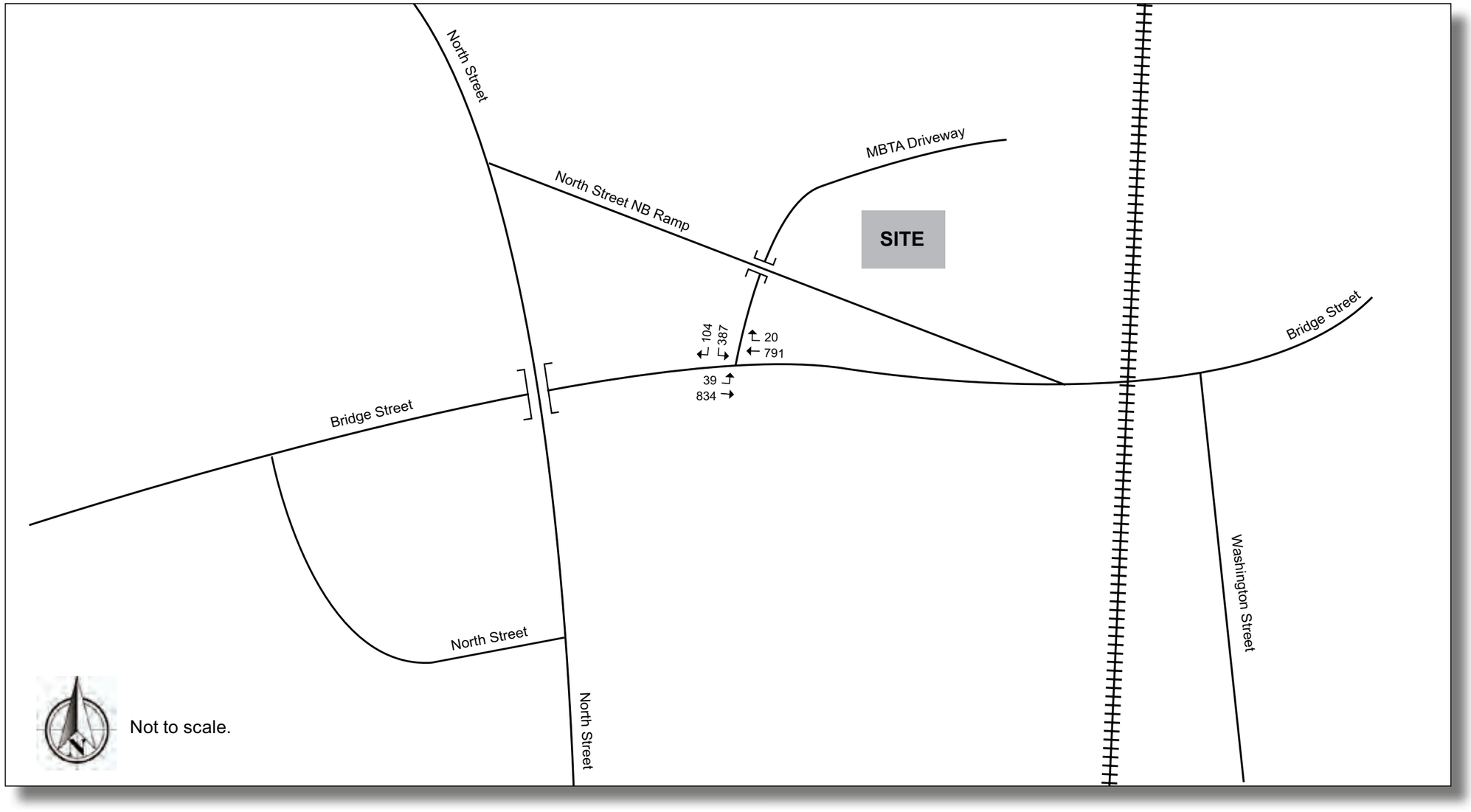


Figure 9. Build Conditions (2015) Traffic Volumes, p.m. Peak Hour (5:00–6:00 p.m.)



4.0 Structural Systems

Walker Parking Consultants is providing functional planning and structural engineering design services as part of the design team.

4.1 Project Understanding

1. The MBTA will be a long-term owner/operator of new 800 space parking structure.
2. There are a number of stakeholder groups within the City of Salem and surrounding communities that are taking great interest in the scale and appearance of the garage structure. These stakeholder groups are also interested in the affect the garage will have on traffic and site access.
3. A specific construction budget has been identified for the new parking facility. Significant adjustments in scope are proposed by the design team and the MBTA to address project budget constraints. Construction cost control for the project is a significant priority with respect to garage design.
4. The yearly operational costs and long-term maintenance of the facility will be funded separately by the MBTA operating budgets. The MBTA has indicated that maintenance requirements and associated costs are a priority.
5. The displacement of the existing on-site parking during construction of the new facility will be a potential inconvenience to the population using the rail station and residents of the surrounding neighborhoods. The degree and time interval of this facilities construction must be minimized.
6. The existing rail platforms must be kept in service for the duration of the construction process.

The basic project parameters advocate a structural system selection process based on project criteria that include:

- Functional design,
- Construction cost/sequence
- System aesthetics
- System durability / anticipated maintenance.

4.2 Functional Design

The parking facility is anticipated to serve patrons of the MBTA commuter rail as well as employees and users of the adjacent court complex. Parking access and revenue control (parc) equipment will be used to collect fees and control access to the facility. Given that the larger of the patron groups are MBTA patrons, it is anticipated that the system for fee collection may incorporate the Charlie Card system in addition to pay-on-foot collection by cash and major credit card. Vehicular access to the proposed parking facility occurs at one ground level location. There is consideration being given to designing the structure to allow an additional vehicle access point at a supported level for a future direct link to the intersection at Bridge and Washington Streets. Internal vehicular circulation is provided by parked on ramps located interior to the footprint of the garage.

MBTA parking standards incorporate an 8'-6‴ by 18' parking stall geometry with a 24′ drive-aisle for 90 degree parking. The parking facility is currently designed with a two-way driving pattern and a 90-degree parking stall. The module width is the required 60 feet and the vehicle spacing will meet or exceed the MBTA requirements. These parking geometrics are recommended for the following reasons:

- Given these parking geometrics, the level of service provided by the design module is level of service B- which is recommended due to the large number of transient parkers in the facility. Throughout the parking facility, the geometric standards will comfortably accommodate a 40 percent small car and a 60 percent large car vehicle mix.
- The 60′ module is typical for parking structures using long-span, precast concrete double tees and complies with the current zoning.
- Based on the above and extensive experience nationwide using similar and tighter modules with large vehicle mixes, we recommend the proposed geometrics as a comfortable design for this application.

The stairs and the elevators have been located within the facility for both egress and patron comfort. The main stair/elevator tower has been located in the northeast corner for easy access to the track platform. A second major stair element is located on the southeast corner of the facility to serve as egress and to service the pedestrian paths to the adjacent court complex. A third and secondary stair has been located at the opposite corner of the facility to address emergency egress path requirements.

Passive security features will be incorporated in the design. The enhancement of passive security will be achieved by providing proper illumination for the parking facility at all locations. This includes general parking areas, roof level, and stairwells. In addition, lighting will be reviewed for the perimeter of the parking facility and public walks. Openness will be enhanced by minimizing hiding places and by providing glazed stairs and vertical circulation core. Landscaping design and maintenance design are also essential for security. Landscaping should not provide hiding places, and general maintenance helps in the overall appearance of security. Graphics and signage are important to eliminate confusion and delay for patrons. Reduction of delay minimizes the time for incidents. The design will also minimize slip/trip hazards. This can be achieved by reducing the need for curbs as much as possible, and assuring an adequate slip resistant surface.

The design will incorporate features that ease maintenance for the parking facility. Three systems for the parking facility require maintenance: operational, structural and aesthetic maintenance.

Operational maintenance includes such items as the lighting and electrical system, elevator, and mechanical systems. Design of these systems will incorporate maintenance considerations.

Structural maintenance is the most expensive for most parking facilities. Durability review will be performed during later phases of design to determine the appropriate durability features for the project.

The facility will also be designed to enhance aesthetic maintenance. This includes areas of landscaping, painting, and general facility appearance. Snow removal and ice control is an important maintenance consideration. Provisions will be considered for incorporation to allow for ease in a blade and dump scenario for the roof level of the parking facility.

4.3 Structural System Options

As the project moved forward with the development of the design concepts, the design team has analyzed the various options for structural systems with respect to the project criteria. There are multiple variations/combinations of structural systems in use for the construction of parking structures utilizing post-tensioned concrete, pre-tensioned concrete, conventionally reinforced concrete and structural steel sections. The following is a description and discussion of the predominant systems available for use in the New England area:

- Cast-in-place Post tensioned Concrete (PT) – Post tensioned concrete slab, beam and girders with conventionally reinforced columns
- Cast-in-place Conventional Reinforced Concrete (RC) – Concrete slab (i.e. waffle, flat plate) and columns.
- Precast Prestressed Concrete (PC) – Precast prestressed double tees and

inverted tee girders supported on conventionally reinforced precast columns, wall panels and spandrels.

- Hybrid - Structural Steel Frame with a concrete deck consisting of one of several systems such as precast double tee beams, post-tensioned concrete slab, or conventionally reinforced concrete slab on metal deck.

Each of these systems presents advantages and disadvantages with respect to addressing this project's design criteria. The following provides Walker comment with respect to each system and the project's design criteria for consideration:

Cast-in-place Post Tensioned (PT)

1. Functional:
   a. Utilizes long span construction to allow the framing bay to match the parking module.
   b. The flat soffit between beams/girders provides for efficient distribution of lights and signage which facilitates vehicular and pedestrian flow within the facility.
   c. Provides good parking efficiency (SF floor area/car).
2. Construction Sequence/Cost:
   a. Built in place, likely to disrupt all parking at garage site during construction.
   b. The construction of this system will allow for the uninterrupted use of the platform and tracks.
   c. Concept level schedule for the construction of the facility is 14 to 18 months exclusive special site considerations.
3. System performance/aesthetics:
   a. Beams spaced at the column lines for minimal obstructions to light distribution.
   b. Clear headroom from floor to underside of slab, except at beam locations, creates an unobstructed view within deck.
   c. Concrete cover in structural members can be modified to accommodate a fire rating.
   d. Edge beams can provide the code required vehicle barriers and be modified for architectural appearance.
   e. Use of moment frames for lateral stability can reduce and in some cases eliminate the need for interior shear wall elements
4. System Durability:
   a. The PT tendons put compressive forces into the slabs and beams which minimizes need for slab jointing and the occurrence of cracking.
   b. Main reinforcing tendons encapsulated in protective sleeves to shield them from corrosive elements.
   c. Limited waterproofing required at congested reinforcing and anchorage locations.

Cast-in-place Conventionally Reinforced (RC)

1. Functional:
   a. Lends itself to short span construction. This requires the placement of columns within the parking module which reduces parking efficiency.
2. Construction Sequence/Cost:
   a. For durability, it is typically necessary to include a comprehensive waterproofing system and built-in measures (i.e. concrete additives, coatings). This can add significant cost.
   b. Entire structure is built in place which is likely to disrupt all parking at garage site during construction.
   c. The construction of this system will allow for the uninterrupted use of the platform and tracks.
   d. Concept level schedule for the construction of the facility is 14 to 18 months exclusive special site considerations.
3. System performance/aesthetics:
   a. In some cases, flat slab (two way) is utilized which provides for minimal obstructions to light distribution. However, short span requires the placement of columns within the parking module that presents obstruction to light and sight lines.
   b. Clear headroom from floor to underside of slab. Creates an unobstructed view (between columns) within deck.
   c. Concrete cover in structural members can be modified to accommodate a fire rating.
   d. Edge beams can provide the code required vehicle barriers and can be modified for architectural appearance.
4. System Durability:
   a. Cracking in the negative moment regions of the slab requires the installation of membranes and other waterproofing/durability measures to protect reinforcement from chloride laden moisture related deterioration.
   b. Monolithic construction can be prone to active cracking. This active cracking promotes moisture intrusion of the slab elements and subsequent corrosion of exposed metal items such as reinforcement and form deck.
   c. Generally requires significant maintenance to repair corrosion induced deterioration and repair worn or failed waterproofing components throughout its service life.

Precast Prestressed Concrete (PC)

1. Functional:
   a. Utilizes long span construction to allow framing bay to match the parking module.
   b. Provides good parking efficiency.
2. Construction Sequence/Cost:
   a. Using a repetitive pattern improves cost efficiency.
   b. Erection may allow some parking to remain in service at different stages of erection.
   c. The construction of this system will allow for the uninterrupted use of the platform and tracks.
   d. Concept level schedule for the construction of the facility is 12 to 16 months exclusive special site considerations.
3. System performance/aesthetics:
   a. Double tee floor members have 30" (+/-) deep stems at roughly 6' centers making the ceiling appear lower.
   b. Way-finding graphics less visible due to tightly spaced tee stems.
   c. Concrete cover in structural members can modified to accommodate a fire rating. Joints between members may require fire rating.
   d. Edge beams (spandrels) can provide the code required vehicle barriers and be modified for architectural appearance.
4. System Durability:
   a. Use of non-corrosive embedments reduce staining and corrosion.
   b. Minimal reinforcing close to the drive surface greatly reduces potential corrosion in slabs.
   c. System requires the installation of sealant around individual PC pieces. Can have literally miles of sealant that require replacement at the end of their service life.

Hybrid (HYB)

1. Functional:
    a. This system can utilize both short and long span construction depending on the deck system incorporated into the design. Long span systems allow framing bay to match the parking module.
    b. Long span system provides good parking efficiency. In cases when short-span system is utilized parking efficiency will decrease similarly to the RC system(s) addressed above.
2. Construction Sequence/Cost:
    a. Costs can be significantly affected by which slab system is chosen. Refer to options discussed above.
    b. Erection may allow some parking to remain in service at different stages of erection.
    c. The construction of this system will allow for the uninterrupted use of the platform and tracks.
    d. Concept level schedule for the construction of the facility is 12 to 16 months exclusive special site considerations.
3. System performance/aesthetics:
    a. Use of moment frames and bents for lateral stability can reduce and in some cases eliminate the need for interior shear wall elements
    b. Steel superstructure requires separate vehicle guards.
    c. Steel superstructure requires spray-applied fireproofing to attain a fire rating when one is mandated by construction type code requirements.
    d. Exterior architectural treatment may require additional members.
    e. Interior aesthetics dependent on chosen floor system. See above systems for discussion.
4. System Durability:
    a. Steel frame must be protected from corrosion, typically by a high performance coating or galvanizing.
        i. High performance coating will require periodic touch-up and re-coating.
        ii. Galvanizing require periodic touch-up at connections and trouble spots.
    b. The durability the floor system varies with the selected system and is discussed in the above options.

4.4 Structural System Recommendations

A number of the systems and their variations can be excluded from further consideration based upon their compatibility with the Salem MBTA project parameters and criteria. A brief discussion and justification for these exclusions are as follows:

Cast-in-place Post-tensioned Concrete (PT): Of all the systems presented, this system provides the most favorable characteristics in terms of inherent durability. In addition, its ability to span the width of the average parking module means that it meets or exceeds the ability of the other systems with respect to functional design, aesthetic qualities and system performance. It is however historically the more costly of the systems presented to construct in the northeast market and can take longer to erect on site than some of the other systems presented. It should be noted that in terms of life cycle maintenance it is less costly to maintain than the systems that rely more on waterproofing systems (sealants and membranes) to protect the structure from moisture related deterioration. However, the savings in projected service life costs do not offset the increase in capital cost for the Salem MBTA project. As a result it is Walker's recommendation that it be eliminated from consideration for use on this project.

Cast-in-place Conventional Reinforced Concrete (RC): This system provides less favorable characteristics in terms of inherent durability than the post-tensioned and pre-tensioned slab systems. In addition, the need to install and then maintain waterproofing/barrier systems makes this structural system less cost efficient with respect to initial construction as well as service life cost. Lastly, the short to medium span nature of this system lends itself to structures that support other uses (above) in addition to parking such as plaza construction and occupied building spaces. Walker recommends that this system be eliminated for consideration for use on this project.

Hybrid - Steel Frame with PT Concrete Deck: This system provides much of the same inherent durability characteristics as the all concrete PT system. Walker's design experience indicates that the use of composite steel beams/girders with a PT slab system has been problematic and led to unintended cracking issues. In addition, its construction cost and duration of erection schedule is on par with that of the all concrete PT system. Lastly, the current architectural façade design direction includes the use of concrete and potentially masonry veneer spandrel/wall sections which are less efficient to accommodate on a steel frame structure than some of the CIP and precast concrete systems under consideration. Walker recommends that this system be eliminated for consideration for use on this project.

Hybrid – Steel Frame with RC/CIP Slab (with and without form deck): This system provides less favorable characteristics in terms of inherent durability than the post-tensioned and pre-tensioned concrete deck systems. This system can be cost efficient from an initial construction cost standpoint but historically has been shown to perform poorly in the northeast area of the US from a durability standpoint. This can lead to prohibitively high maintenance and repair costs over the service life of the structure. Lastly, the current architectural façade design direction includes the use of concrete and potentially masonry veneer spandrel/wall sections which are less efficient to accommodate on a steel frame structure than some of the CIP and precast concrete systems under consideration. For these reasons it is Walker's recommendation that this group of system(s) be eliminated from consideration for use on this project.

Hybrid - Steel Frame with pre-tensioned precast concrete deck system: This system provides much of the same inherent durability characteristics as the all concrete pre-tensioned precast system. In addition, its construction cost, projected service life cost and duration of erection schedule is on par with that of the all pre-tensioned precast system. The use of an exposed steel frame in close proximity to a marine environment presents maintenance concerns that would be less of a consideration than with the all concrete frame systems. Lastly, the current architectural façade design direction includes the use of concrete and potentially masonry veneer spandrel/wall sections which are less efficient to accommodate on a steel frame structure than some of the CIP and precast concrete systems under consideration. Walker recommends that this system be eliminated for consideration for use on this project.

Upon review it is Walker's opinion that the all pre-tensioned precast concrete system is the

appropriate choice for the Salem MBTA project when the four main project criteria of functional design, cost, aesthetics and durability are considered and weighted. Specific attributes of this system that influenced this recommendation include:

- The all pre-tensioned precast system accommodates the long open spans required for parking efficiency and promotes passive security.

- The footprint of the proposed Salem MBTA project promotes the repetitive use of precast sections.

- The all pre-tensioned precast system can accommodate the architectural façade treatments currently proposed for the structure in an efficient manner.

- Historically, the all pre-tensioned precast system is the most cost efficient long span system available in the Northeast. Cost analysis performed for the Salem MBTA project indicates it can be accommodated in the project budget.

- The projected service life costs for all pre-tensioned precast system indicate that it is the most cost efficient system under consideration when net present value (NPV) is compared to the capital and service life costs of other systems.

- The pre-tensioning of the deck members and the use durability enhancements such as stainless steel embedments and corrosion inhibitor admixtures will provide for a 40 plus year expected service life.

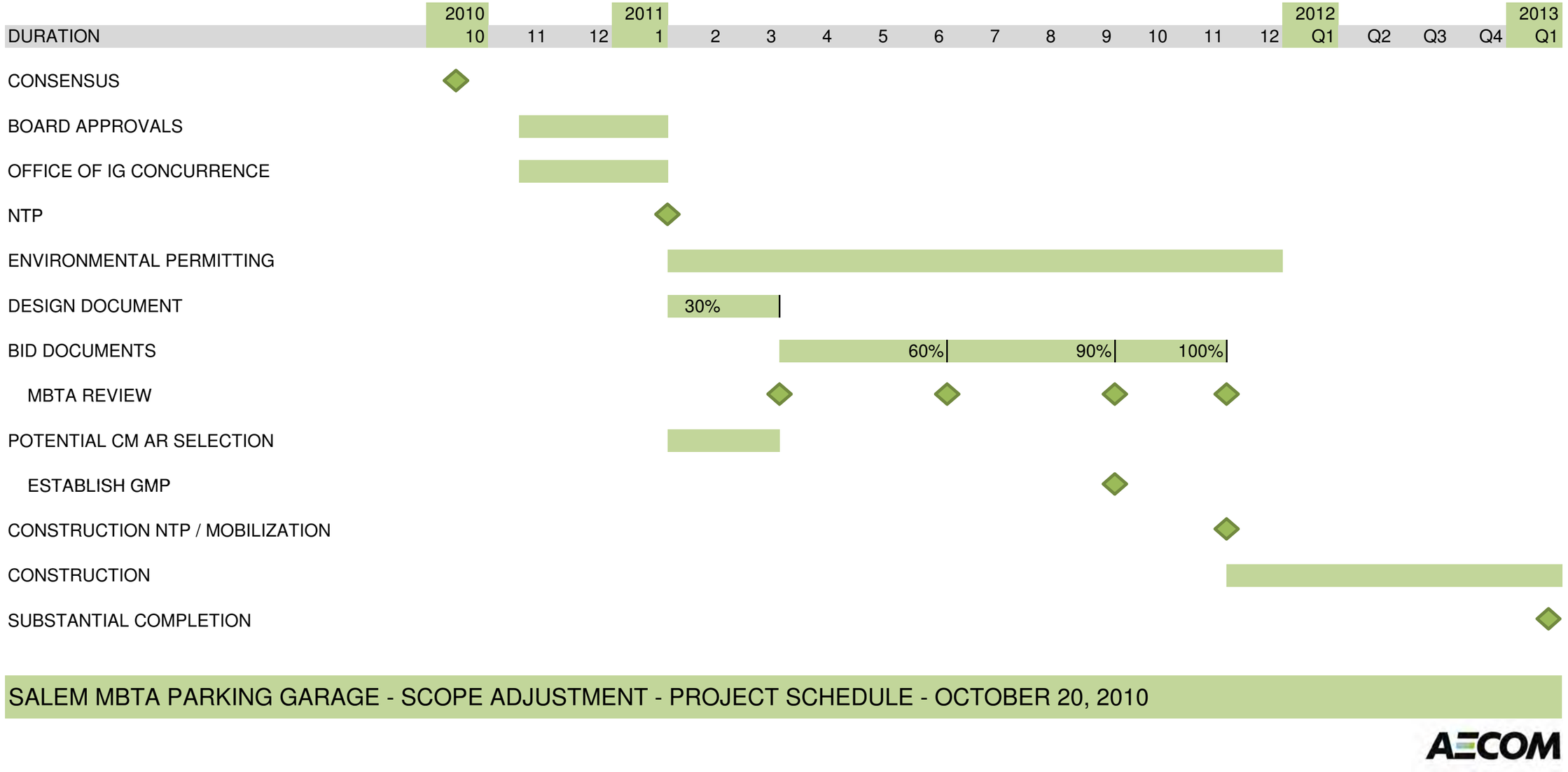
5.0 Proposed Schedule

The project schedule is being developed with the MBTA. Items to be addressed included:

- Construction Procurement Methodology (e.g., Ch149A CMAR)
- Construction Phasing Alternatives
- Environmental Permitting

At this time, environmental permitting appears to be the “critical path” with respect to design. The draft schedule indicates a duration of approximately 11 months for environmental permitting. Assuming that this effort is initiated in January 2011, construction could commence in November/December 2011.

DRAFT



SALEM MBTA PARKING GARAGE - SCOPE ADJUSTMENT - PROJECT SCHEDULE - OCTOBER 20, 2010

AECOM

6.0 Project Costs

Construction cost estimates have been developed for the preliminary order of magnitude costs included in this report. Refer to Section 2.0 for conceptual scheme and Appendix 8.0 for conceptual cost estimate including scope adjustments.

The construction cost estimate with scope adjustments is $24.9 million, of which approximately $18.0 million is associated with the garage itself.

The project budget including soft costs (owner costs, design fees, etc.) is being developed in conjunction with the MBTA. The target project budget is $30.0 million.

Additional scope items beyond the current project budget could include:

- Provisions for a +/-2,000sf Registry Express adjacent to the waiting area, proximate to site access from Washington Street.
- Provision of (2) toilet rooms.
- Extended platform canopies.
- Additional brick exterior.
- Future pedestrian and vehicular bridge connections from Washington Street.

7.0 Next Steps

There is consideration being given to designing the structure to allow an additional vehicle access point at a supported level for a future direct link to the intersection at Bridge and Washington Streets.

In addition to development & documentation of the design, next steps include:

- Environmental Permitting
- Geotechnical Evaluation
- Traffic Analysis
- Construction Phasing / Implementation
- Construction Procurement Methodology
- Coordination of Bridge Street improvements for future development of rail line row

8.0 Appendices

- Scope Adjustment Summary, dated September 10, 2010 revised
- Parking Garage Salem, MA: Conceptual Design Estimate Dated August 19, 2010
- Salem MBTA Parking Garage Salem, MA: Conceptual Design Estimate Dated August 19, 2010
- Annual Maintenance Cost New Facility (Design Development Level Service Life Cost Study), dated September 3, 2010

September 10, 2010 revised

MBTA SALEM COMMUTER RAIL STATION GARAGE AND STATION IMPROVEMENTS

SCOPE ADJUSTMENT SUMMARY

Item		In Scope	Not in Scope
Full-high platform		$4,655,800	
Registry Express			$576,000
Toilet Rooms			$99,500
Add Masonry at East Elevation			$362,900
Add Masonry at South Elevation			$518,400
Add Masonry at North Elevation			$518,400
Add Canopy to North of Garage			$490,500
Future Pedestrian Bridge to Washington Street			$1,500,000
Future Vehicular Bridge to Washington Street			$3,850,000
Note: all items include General Conditions and Requirements, Permits, Insurance, Fee and Escalation			

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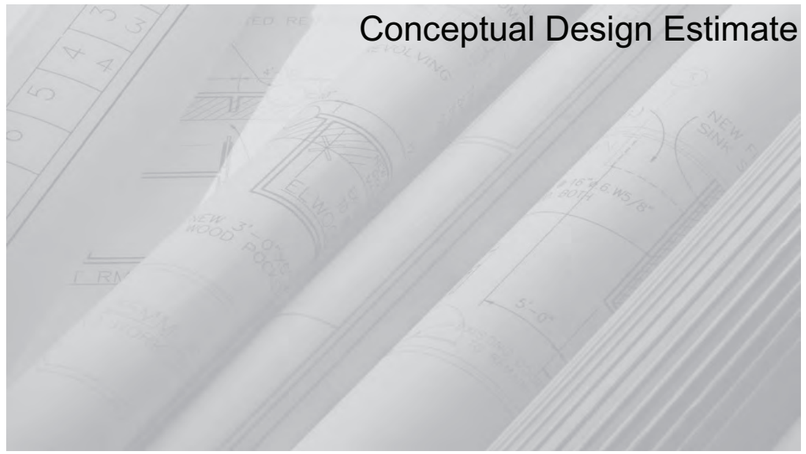
Parking Garage
Salem , MA

August 19, 2010



Architect:
AECOM
66 Long Wharf
Boston MA 02110
(617) 723-1700

Cost Estimator:
Daedalus Projects, Inc.
112 South Street
Boston, MA 02111
(617) 451 2717

INTRODUCTION

Project Description:

Construction of new 272,000 gross square foot Parking Garage, For the purpose of this estimate, it has been assumed that all the parking is on and above grade

It has been assumed that there will be 1 level on grade and 4 above grade levels using a precast double T system with brick and precast spandrel panels

Project Particulars:

Conceptual design drawings issued by AECOM dated 7/16/2010.

Detailed quantity takeoff from these documents where possible.

Daedalus Projects, Inc. experience with similar projects of this nature.

Project Assumptions:

- The project will be a public bid, using the services of aGC . Our costs assume that there will be at least four subcontractors submitting unrestricted bids in each sub-trade,
- Unit rates are based on current dollars (July 2010)
- Subcontractor's markups have been included in each unit rate. Markups cover the cost of field overhead, home office overhead and subcontractor's profit.
- Design and Pricing Contingency markup is an allowance for unforeseen design issues, design detail development and specification clarifications.
- General Conditions and Requirements value covers site office overhead.
- Overhead and profit markup is calculated on a percentage basis of direct construction costs.

Project Exclusions:

- Design fees and other soft costs.
- Interest expense.
- Owner's project administration.
- Construction contingency.
- Pre-construction service fee
- Construction of temporary facilities including provision of temporary rooms
- Relocation expenses.
- Printing and advertising.

INTRODUCTION

- Specialties, loose furnishings, fixtures and equipment beyond what is noted.
- Work beyond the boundary of the site, unless otherwise stated.
- Vehicular Connection from Washington street
- Special pedestrian access from Washington street
- Covered bus bays
- 6th Level of Parking structure
- Work to state or city highways and streets

MAIN SUMMARY

	GSF		TOTAL	COST/SF
Site Development			$1,270,735	
Enclosed Office/Desk Space (1 Story, 2000 GSF)			NA	
Parking Garage		272,000 GSF	$12,323,610	$45.31
Sub-total			**$13,594,345**	**$49.98**
Design Contingency	10.0%		$1,359,435	$5.00
			$14,953,780	**$54.98**
Markups				
General Conditions and Requirements	1	LS	$1,196,302	$4.40
Permit	1.2%		$179,445	$0.66
Insurance	1%		$149,538	$0.55
Fee	3.00%		$448,613	$1.65
Phasing	5%		$747,689	$2.75
Escalation	2.00%		$299,076	$1.10
ESTIMATED CONTRACT VALUE			**$17,974,443**	$66.08
Cost per space			**$22,724**	**791 Spaces**
Parking access and revenue control; ALLOWANCE **(Not included in Estimated Contract Value)**			**$400,000**	

SITE DEVELOPMENT SUMMARY

ELEMENT	
265600-Site Electrical	$202,500
26-ELECTRICAL	**$202,500**
311110 Clearing and Grub Site	$84,592
311410-Dewatering	$40,000
311610-Excavation Support and Protection	$37,160
312000-Earth Moving	$125,868
312500-Erosion and Sedimentation Controls	$59,761
31-EARTHWORK	**$347,381**
321216- Asphalt Paving	$122,930
321313-Concrete Paving	$41,746
321600-Curbing	$90,848
321700-Site Improvement	$53,100
323113-Fences and Gates	$65,000
329200-Turf and Grasses	$3,985
329300-Plants	$73,245
32-EXTERIOR IMPROVEMENT	**$450,854**
331100-Water Utility Distribution Piping	$70,000
333100-Sanitary Utility Sewerage System	$50,000
334100-Storm Utility Drainage System	$150,000
33-UTILITIES	**$270,000**
Subtotal	**$1,270,735**

SITE DEVELOPMENT

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
50	**02-EXISTING CONDITIONS**				
51					
52	**26-ELECTRICAL**				
53					
54	**265600-Site Electrical**				
55	Site electrical allowance including lighting	**1**	LS	$150,000.00	$150,000
56	Site lighting (assume 15 pole lights)	**15**	EA	$3,500.00	$52,500
57	Canopy lighting	**9,557**	SF	$5.00	MBTA
	Canopy lighting at High-level platform	**10,635**	SF	$5.00	MBTA
59	**265600-Site Electrical total**				$202,500
60					
61	**31-EARTHWORK**				
62					
63	**311110 Clearing and Grub Site**				
64	Site clearance allowance	**169,184**	SF	$0.50	$84,592
65	**311110 Clearing and Grub Site total**				$84,592
66					
67	**311410-Dewatering**				
68	Dewatering allowance	**1**	LS	$40,000.00	$40,000
69	**311410-Dewatering total**				$40,000
70					
71	**311610-Excavation Support and Protection**				
72	8' Construction fence, install & maintain	**2,296**	LF	$10.00	$22,960
73	Double construction Gate allowance	**2**	EA	$1,600.00	$3,200
74	Construct. entrance-gravel bed, construct and maintain	**2**	EA	$5,500.00	$11,000
75	**311610-Excavation Support and Protection total**				$37,160
76					
77	**312000-Earth Moving**				
78	Site cut & fill allowance	**892**	CY	$8.00	$7,137
79	Cut & fill of roadway, parking lot allowance	**3,546**	CY	$9.00	$31,913
80	Cut & fill of concrete sidewalk allowance	**241**	CY	$9.00	$2,173
81	New gas service for building - excavate trench only	**200**	LF	$50.00	$10,000
82	Gravel base to surfacing	**2,986**	CY	$25.00	$74,646
83	**312000-Earth Moving total**				$125,868
84					
85	**312500-Erosion and Sedimentation Controls**				
86	Hay bales and silt fence including maintenance allowance	**2,169**	LF	$4.50	$9,761
87	Storm water management plan	**1**	LS	$50,000.00	$50,000
88	**312500-Erosion and Sedimentation Controls total**				$59,761
89					

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
90					
91	**32-EXTERIOR IMPROVEMENT**				
92					
93	**321216- Asphalt Paving**				
94	Bit concrete pavement -parking lot	**12,527**	SF	$2.30	$28,812
95	Bit roadway pavement	**35,342**	SF	$2.45	$86,588
96	Parking stall painting, type.	**20**	EA	$35.00	$700
97	Painted cross walk allowance	**1,830**	SF	$1.00	$1,830
98	Misc. markings	**1**	LS	$5,000.00	$5,000
99	**321216- Asphalt Paving total**				$122,930
100					
101	**321313-Concrete Paving**				
102	Concrete sidewalk	**6,518**	SF	$5.00	$32,590
103	New ramp	**908**	SF	$7.00	$6,356
104	Curb cut allowance	**8**	EA	$350.00	$2,800
105	**321313-Concrete Paving total**				$41,746
106					
107	**321600-Curbing**				
108	Granite Curbing allowance	**2,672**	LF	$34.00	$90,848
109	**321600-Curbing total**				$90,848
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Parking Garage
SITE DEVELOPMENT
Salem , MA

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
131					
132	**321700-Site Improvement**				
133	Canopy	**9,557**	SF	$135.00	MBTA
134	*Concrete full height platform*	***10,498***	*SF*		
135	Excavation to:				
136	New strip foundation excavation	**2,083**	CY	$8.00	MBTA
137	Excavation of slab on grade	**583**	CY	$9.00	MBTA
138	Gravel base to slab on grade	**355**	CY	$25.00	MBTA
139	Concrete to:				
140	Strip footings	**131**	CY	$150.00	MBTA
141	Foundation wall	**264**	CY	$150.00	MBTA
142	Slab on grade 5" thick allowance	**170**	CY	$130.00	MBTA
143	Reinforcing to:				
144	Strip footings	**10,500**	LBS	$1.05	MBTA
145	Foundation wall	**30,338**	LBS	$1.05	MBTA
146	Slab; w.w.f 15% allowance for laps	**12,073**	SF	$0.55	MBTA
147	Tactile warning strip	**457**	LF	$35.00	MBTA
148	Formwork to:				
149	Strip footings	**2,250**	SF	$7.00	MBTA
150	Foundation wall	**20,250**	SF	$8.00	MBTA
151	*Proposed high-level platform*	***10,635***	*SF*		
152	Canopy	**22,719**	SF	$135.00	MBTA
153	Excavation to:				
154	New strip foundation excavation	**2,930**	CY	$8.00	MBTA
155	Excavation of slab on grade	**591**	CY	$9.00	MBTA
156	Gravel base to slab on grade	**360**	CY	$25.00	MBTA
157	Concrete to:				
158	Strip footings	**246**	CY	$150.00	MBTA
159	Foundation wall	**453**	CY	$150.00	MBTA
160	Slab on grade 5" thick allowance	**172**	CY	$130.00	MBTA
161	Reinforcing to:				
162	Strip footings	**19,687**	LBS	$1.05	MBTA
163	Foundation wall	**52,143**	LBS	$1.05	MBTA
164	Slab; w.w.f 15% allowance for laps	**12,230**	SF	$0.55	MBTA
165					
166					
167					
168					
169					
170					
171					

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
172					
173	Tactile warning strip	**782**	LF	$35.00	MBTA
174	Formwork to:				
175	Strip footings	**3,164**	SF	$7.00	MBTA
176	Foundation wall	**34,804**	SF	$8.00	MBTA
177	Railing at High-level platform	**292**	LF	$150.00	MBTA
178	Sheltd	**7**	SF	$10,000.00	MBTA
179	Bumpers	**1**	LS	$25,000.00	MBTA
180	Signage	**1**	LS	$5,000.00	MBTA
181	*Concrete ramp:*				
182	Excavation of slab on grade	**122**	CY	$9.00	MBTA
183	Gravel base to slab on grade	**84**	CY	$25.00	MBTA
184	Slab on grade 5" thick allowance	**40**	CY	$130.00	MBTA
185	Railing at concrete ramp	**262**	LF	$85.00	MBTA
186	Dumpster with enclosure allowance	**1**	EA	$1,600.00	MBTA
187	Dumpster pad allowance	**1**	LS	$1,200.00	MBTA
188	Equipment pad allowance	**1**	LS	$800.00	$800
189	Trash / Recycle Receptacles allowance	**4**	EA	$700.00	$2,800
190	60 foot high tapered anodized aluminum flagpole with	**1**	EA	$7,500.00	MBTA
191	internal halyard system and 8 foot by 12 foot flag.				
192	Bike rack and enclosure	**1**	AL	$20,000.00	MBTA
193	Benches allowance	**1**	AL	$14,400.00	MBTA
194	Bollards allowance	**12**	EA	$750.00	$9,000
195	Traffic signage allowance	**1**	LS	$5,500.00	$5,500
196	Building signs allowance	**1**	AL	$35,000.00	$35,000
197	**321700-Site Improvement total**				$53,100
198					
199					
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211					
212					

AEDALUS
Parking Garage
SITE DEVELOPMENT
Salem , MA

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
213					
214	**323113-Fences and Gates**				
215	Security gate	1	EA	$45,000.00	$45,000
216	Fence allowance	**1**	LS	$20,000.00	$20,000
217	**323113-Fences and Gates total**				$65,000
218					
219	**329200-Turf and Grasses**				
220	Lawn allowance	**8,529**	SF	$0.35	$2,985
221	Mulch allowance	**25**	CY	$40.00	$1,000
222	**329200-Turf and Grasses total**				$3,985
223					
224	**329300-Plants**				
225	Deciduous Trees	**8**	EA	$700.00	$5,600
226	Groundcover allowance	**8,529**	SF	$5.00	$42,645
227	Planting other than above allowance	**1**	LS	$25,000.00	$25,000
228	**329300-Plants total**				$73,245
229					
230					
231	**33-UTILITIES**				
232					
233	**331100-Water Utility Distribution Piping**				
234	Water utility distribution piping allowance	**1**	LS	$70,000.00	$70,000
235	**331100-Water Utility Distribution Piping total**				$70,000
236					
237	**333100-Sanitary Utility Sewerage System**				
238	Sanitary utility sewerage system allowance	**1**	LS	$50,000.00	$50,000
239	**333100-Sanitary Utility Sewerage System total**				$50,000
240					
241	**334100-Storm Utility Drainage System**				
242	Storm utility drainage system allowance	**1**	LS	$150,000.00	$150,000
243	**334100-Storm Utility Drainage System total**				$150,000
244					

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BUILDING SUMMARY

Parking Garage
Salem , MA
272,000 GSF

ELEMENT	COST	COST/SF
02200-Earthwork	$310,315	$1.14
02-SITEWORK TOTAL	**$310,315**	**$1.14**
03 3000 Cast-in-Place Concrete	$1,794,964	$6.60
03 4100 Precast Structural Concrete	$6,509,775	$23.93
03-CONCRETE TOTAL	**$8,304,739**	**$30.53**
04 0510 Unit Masonry Assemblies	$746,454	$2.74
04-MASONRY TOTAL	**$746,454**	**$2.74**
05 1200 Structural Steel	$35,750	$0.13
05 3123 Metal Roof Decking	$10,010	$0.04
05 5000 Metal Fabrications	$202,690	$0.75
05-METALS TOTAL	**$248,450**	**$0.78**
07 1326 Self-Adhering Sheet Waterproofing	$7,617	$0.03
07 1613 Polymer Modified-Cement Waterproofing	$3,000	$0.01
07 4243 Composite Wall Panels	$0	$0.00
07 5419 Polyvinyl-Chloride (PVC) Roofing	$0	$0.00
07-THERMAL & MOISTURE PROTECTION TOTAL	**$10,617**	**$0.04**
08 1113 Hollow metal doors and frames	$7,000	$0.03
08 3613.13 Alum.-Framed Entrances & Storefronts	$0	$0.00
08 7111- Door Hardware	$4,200	$0.02
08-DOORS & WINDOWS TOTAL	**$11,200**	**$0.04**
09 3000 Tiling	$0	$0.00
09 9100 Painting	$75,316	$0.28
09-FINISHES TOTAL	**$75,316**	**$0.28**
10 1400-Signage	$95,200	$0.35
10 2801 Toilet and Bath Accessories	$0	$0.00
10 4406 Fire Extinguishers and Cabinets	$1,800	$0.01
10-SPECIALTIES TOTAL	**$97,000**	**$0.36**
11 1500-Parking Control Equipment	NIC	
11-EQUIPMENT TOTAL	**$0**	**$0.00**

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BUILDING SUMMARY

Parking Garage
Salem , MA
272,000 GSF

ELEMENT	COST	COST/SF
14 2400- Traction Elevator	$240,000	$0.88
14-CONVEYING SYSTEMS TOTAL	**$240,000**	**$0.88**
21 0001-Fire Protection	$305,918	$1.12
22 0001-Plumbing	$321,600	$1.18
23 0001-HVAC	$20,000	$0.07
MECHANICAL TOTAL	**$647,518**	**$2.38**
26 0001 Electrical	$1,632,000	$6.00
26-ELECTRICAL TOTAL	**$1,632,000**	**$6.00**
Subtotal Carried to Main Summary	**$12,323,610**	**$45.31**

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
8	**02-BUILDING SITEWORK**				
9					
10	**02200-Earthwork**				
11	Rough grade for slab on grade	**58,497**	SF	$0.70	$40,948
12	New foundation excavation	**3,364**	CY	$11.00	$37,004
13	Backfill, using imported clean fill	**1,223**	CY	$24.00	$29,353
14	Disposal off site	**3,364**	CY	$18.00	$60,552
15	Elevator pit excavation	**1**	EA	$3,800.00	$3,800
16	Perimeter foundation drainage allowance	**1,220**	LF	$15.00	$18,299
17	Crushed stone base to slab	**1,512**	CY	$30.00	$45,360
18	De-watering	**1**	LS	$25,000.00	$25,000
19	Earthwork support	**1**	LS	$50,000.00	$50,000
20	**02200-Earthwork total**				$310,315
21					
22					
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	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
46					
47	**03-CONCRETE**				
48					
49	**03 3000 Cast-in-Place Concrete**				
50	Concrete to:				
51	Grade beams	**752**	CY	$185.00	$139,120
52	Pile caps	**210**	CY	$185.00	$38,850
53	Structured Slab on grade 6" thick allowance	**1,077**	CY	$185.00	$199,245
54	Ramp, assume 6" thickness allowance	**111**	CY	$185.00	$20,556
55	Reinforcing to:				
56	Grade beams	**139,120**	LBS	$1.05	$146,076
57	Pile caps	**31,500**	LBS	$1.05	$33,075
58	Structured Slab on grade 6" thick allowance	**161,550**	LBS	$1.05	$169,628
59	Ramp, assume 6" thickness allowance	**16,667**	LBS	$1.05	$17,500
60	Formwork:				
61	Grade beams	**10,156**	SF	$10.00	$101,560
62	Pile caps	**3,780**	SF	$10.00	$37,800
63	Structured Slab on grade 6" thick allowance	**5,399**	SF	$10.00	$53,990
64	Concrete beam at ramp	**576**	SF	$13.00	$7,488
65	Miscellaneous:				
66	Piles	**55,392**	SF	$12.00	$664,704
67	Sealed concrete floor, slab on grade allowance	**55,392**	SF	$0.50	$27,696
68	Vapor barrier	**55,392**	SF	$1.00	$55,392
69	Slab isolation joints	**3,545**	LF	$5.00	$17,725
70	Expansion joint at ramp	**128**	LF	$100.00	$12,800
71	Elevator pit mat walls and slab	**1**	LS	$7,000.00	$7,000
72	Eliminate concrete for enclosed area including toilet rms	**2,048**	SF	($5.00)	($10,240)
73	Keyway and waterstops	**1**	LS	$5,000.00	$5,000
74	Casting in accessories	**1**	LS	$20,000.00	$20,000
75	Winter working premium	**1**	LS	$30,000.00	$30,000
76	**03 3000 Cast-in-Place Concrete total**				$1,794,964
77					
78	**03 4100 Precast Structural Concrete**				
79	Precast structural included doublet tee beams & column	**216,554**	SF	$27.00	$5,846,958
80	($/SF Number provided by Walker)				
81	Traffic topping	**4,000**	SF	$3.50	$14,000
82	Penetrating silane sealer	**216,554**	SF	$0.50	$108,277
83	Architectural precast concrete panel	**12,870**	SF	$42.00	$540,540
84	**03 4100 Precast Structural Concrete total**				$6,509,775
85					

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
86					
87	**04-MASONRY**				
88					
89	**04 0510 Unit Masonry Assemblies**				
90	Scaffolding	**11,018**	SF	$2.00	$22,036
91	12" CMU wall @ lower level	**2,184**	SF	$20.00	$43,680
92	8" CMU wall @ lower level	**3,633**	SF	$18.00	$65,394
93	Eliminate walls for restrooms	**360**	SF	($18.00)	($6,480)
94	12" CMU at Elevator shaft wall	**2,393**	SF	$20.00	$47,864
95	12" CMU at stair	**2,448**	SF	$20.00	$48,960
96	Brick	**15,000**	SF	$35.00	$525,000
97	**04 0510 Unit Masonry Assemblies total**				$746,454
98					
99					
100	**05-METALS**				
101					
102	**05 1200 Structural Steel**				
103	Structural steel for roof - at 10 lbs / sq. ft	**14.3**	TON	$2,500.00	$35,750
104	**05 1200 Structural Steel total**				$35,750
105					
106	**05 3123 Metal Roof Decking**				
107	Metal deck for roof	**2,860**	SF	$3.50	$10,010
108	**05 3123 Metal Roof Decking total**				$10,010
109					
110	**05 5000 Metal Fabrications**				
111	Elevator pit ladder and sill angles	**1**	SET	$2,250.00	$2,250
112	Metal guardrail and support at ramp	**468**	LF	$80.00	$37,440
113	Pipe bollards allowance	**16**	EA	$400.00	$6,400
114	Impact protection barriers allowance	**500**	LF	$70.00	$35,000
115	Metal staircases with wall mounted handrails and balustrades	**12**	FLTS	$9,300.00	$111,600
116	Misc metals not identified above	**2**	TNS	$5,000.00	$10,000
117	**05 5000 Metal Fabrications total**				$202,690
118					
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Parking Garage
Salem , MA
272,000 GSF

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
126					
127	**07-THERMAL AND MOISTURE PROTECTION**				
128					
129	**07 1326 Self-Adhering Sheet Waterproofing**				
130	Dampproof foundations	**5,078**	SF	$1.50	$7,617
131	**07 1326 Self-Adhering Sheet Waterproofing total**				$7,617
132					
133	**07 1613 Polymer Modified-Cement Waterproofing**				
134	Crystalline waterproofing to elevator pits	**1**	EA	$3,000.00	$3,000
135	**07 1613 Polymer Modified-Cement Waterproofing total**				$3,000
136					
137	**07 4243 Composite Wall Panels**				
138	Included in storefront price		SF		$0
139	**07 4243 Composite Wall Panels total**				
140					
141	**07 5419 Polyvinyl-Chloride (PVC) Roofing**				
142	PVC Roof, densdeck, insulation	**2,860**	SF	$10.75	MBTA
143	**07 5419 Polyvinyl-Chloride (PVC) Roofing total**				$0
144					
145					
146	**08-DOORS AND WINDOWS**				
147					
148	**08 1113 Hollow metal doors and frames**				
149	Single metal door & frames	**5**	EA	$1,000.00	$5,000
150	Bathroom doors (MBTA)	**-2**	EA	$1,000.00	($2,000)
151	Double metal door & frames	**2**	PR	$2,000.00	$4,000
152	**08 1113 Hollow metal doors and frames total**				$7,000
153					
154	**08 3613.13 Alum.-Framed Entrances & Storefronts**				
155	Aluminum panel / storefront system	**2,646**	SF	$70.00	MBTA
156	Entrance or vestibule doors, glazed single	**4**	PR	$7,000.00	MBTA
157	Premium for electric operation	**2**	EA	$2,800.00	MBTA
158	**08 3613.13 Alum.-Framed Entrances & Storefronts total**				$0
159					
160	**08 7111- Door Hardware**				
161	Hardware sets, average cost	**9**	SETS	$600.00	$5,400
162	Bathroom doors (MBTA)	**-2**	EA	$600.00	($1,200)
163	**08 7111- Door Hardware total**				$4,200
164					
165					

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
166					
167	**09-FINISHES**				
168					
169	**09 3000 Tiling**				
170	Tile floors	**200**	SF	$15.00	MBTA
171	Ceramic wall tile	**954**	SF	$15.00	MBTA
172	Ceramic tile base	**106**	LF	$13.00	MBTA
173	Granite thresholds	**2**	EA	$65.00	MBTA
174	**09 3000 Tiling total**				$0
175					
176	**09 9100 Painting**				
177	Paint CMU walls	**14,004**	SF	$1.50	$21,006
178	Paint door and frame	**9**	LEAF	$105.00	$945
179	Parking stall painting, type.	**774**	EA	$35.00	$27,090
180	Parking stall -accessible	**17**	EA	$75.00	$1,275
181	Msic pavement painting	**1**	LS	$15,000.00	$15,000
182	Painting metal surfaces (stairs, handrails etc)	**1**	LS	$10,000.00	$10,000
183	**09 9100 Painting total**				$75,316
184					
185					
186	**10-SPECIALTIES**				
187					
188	**10 1400-Signage**				
189	Signage required by code	**272,000**	SF	$0.35	$95,200
190	**10 1400-Signage total**				$95,200
191					
192	**10 2801 Toilet and Bath Accessories**				
193	Toilet accessories allowance	**1**	LS	$1,000.00	MBTA
194	**10 2801 Toilet and Bath Accessories total**				$0
195					
196	**10 4406 Fire Extinguishers and Cabinets**				
197	Fire extinguishers,	**4**	EA	$450.00	$1,800
198	**10 4406 Fire Extinguishers and Cabinets total**				$1,800
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AEDALUS

Parking Garage
Salem , MA
272,000 GSF

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
205					
206	**11- EQUIPMENT**				
207					
208	**11 1500-Parking Control Equipment**				
209	Parking access and revenue control				NIC
210	**11 1500-Parking Control Equipment total**				NIC
211					
212	**14-CONVEYING SYSTEM**				
213					
214	**14 2400- Traction Elevator**				
215	Hydraulic elevator, 4 stop, 3500 Lb.	**2**	EA	$120,000	$240,000
216	**14 2400- Traction Elevator total**				$240,000
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	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
244					
245	**15-MECHANICAL**				
246					
247	**21 0001-Fire Protection**				
248	Sprinkler Coverage	**55,392**	SF	$4.00	$221,568
249	Dry Alarm Valve w/compressor	**-**	EA	N/A	$0
250	Fire Dept. Connections	**2**	EA	$2,500.00	$5,000
251	FDV w/ 6" standpipe (two standpipes)	**10**	EA	$1,500.00	$15,000
252	Main piping:				
253	- 6"	**700**	LF	$85.00	$59,500
254	Coring, Sleeves & sleeves	**1**	LS	$1,250.00	$1,250
255	Lift	**1**	LS	$1,000.00	$1,000
256	Permits & Fees	**1**	LS	$750.00	$750
257	Shop drawings/hydraulic calculations	**1**	LS	$1,850.00	$1,850
258	**21 0001-Fire Protection total**				$305,918
259					
260	**22 0001-Plumbing**				
261	Water Closet	**2**	EA	$3,900.00	MBTA
262	Lavatory	**2**	EA	$3,900.00	MBTA
263	Oily Water Separator	**1**	EA	$10,000.00	$10,000
264	Sand Seapartor	**1**	EA	$15,000.00	$15,000
265	Trench Drains	**1**	LS	$12,000.00	$12,000
266	Floor Drains (garage)	**60**	EA	$3,000.00	$180,000
267	Roof Drains	**20**	EA	$4,800.00	$96,000
268	Permits & Fees	**1**	EA	$2,000.00	$2,000
269	Test and sterilize	**1**	EA	$2,100.00	$2,100
270	Shop drawings	**1**	EA	$4,500.00	$4,500
271	**22 0001-Plumbing total**				$321,600
272					
273	**23 0001-HVAC**				
274	Exhaust for basement	**1**	LS	$20,000.00	$20,000
275	**23 0001-HVAC total**				$20,000
276					
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DAEDALUS

Parking Garage
Salem , MA
272,000 GSF

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
283					
284	**16-ELECTRICAL**				
285					
286	**26 0001 Electrical**				
287	Allow for "Plug-In" Electric cars	**4**	LOC	$2,500.00	MBTA
288	Electrical allowance	**272,000**	SF	$6.00	$1,632,000
289	**26 0001 Electrical total**				$1,632,000
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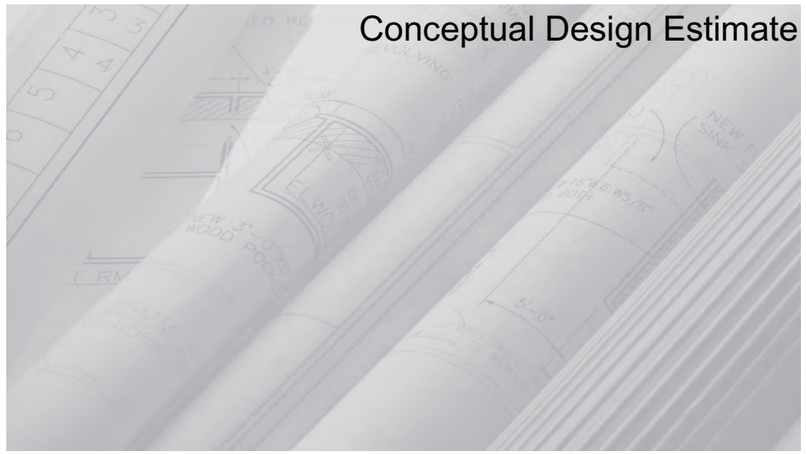
Salem MBTA Parking Garage
Salem , MA

August 19, 2010



Architect:
AECOM
66 Long Wharf
Boston MA 02110
(617) 723-1700

Cost Estimator:
Daedalus Projects, Inc.
112 South Street
Boston, MA 02111
(617) 451 2717

INTRODUCTION

Project Description:

Construction of new 272,000 gross square foot Parking Garage, For the purpose of this estimate, it has been assumed that all the parking is on and above grade

It has been assumed that there will be 1 level on grade and 4 above grade levels using a precast double T system with brick and precast spandrel panels

Project Particulars:

Conceptual design drawings issued by AECOM dated 7/16/2010.

Detailed quantity takeoff from these documents where possible.

Daedalus Projects, Inc. experience with similar projects of this nature.

Project Assumptions:

- The project will be a public bid, using the services of aGC . Our costs assume that there will be at least four subcontractors submitting unrestricted bids in each sub-trade,
- Unit rates are based on current dollars (July 2010)
- Subcontractor's markups have been included in each unit rate. Markups cover the cost of field overhead, home office overhead and subcontractor's profit.
- Design and Pricing Contingency markup is an allowance for unforeseen design issues, design detail development and specification clarifications.
- General Conditions and Requirements value covers site office overhead.
- Overhead and profit markup is calculated on a percentage basis of direct construction costs.

Project Exclusions:

- Design fees and other soft costs.
- Interest expense.
- Owner's project administration.
- Construction contingency.
- Pre-construction service fee
- Construction of temporary facilities including provision of temporary rooms
- Relocation expenses.
- Printing and advertising.

INTRODUCTION

- Specialties, loose furnishings, fixtures and equipment beyond what is noted.
- Work beyond the boundary of the site, unless otherwise stated.
- Vehicular Connection from Washington street
- Special pedestrian access from Washington street
- Covered bus bays
- 6th Level of Parking structure
- Work to state or city highways and streets

MAIN SUMMARY

	GSF			TOTAL	COST/SF
Site Development				$6,878,756	
Enclosed Office/Desk Space (1 Story, 2000 GSF)			2,000 GSF	$500,000	$250.00
Parking Garage			272,000 GSF	$12,637,793	$46.46
		Sub-total		**$20,016,549**	**$73.05**
		Design Contingency	10.0%	$2,001,655	$7.31
				$22,018,204	**$80.36**
Markups					
	General Conditions and Requirements	1	LS	$1,761,456	$6.43
		Permit	1.2%	$264,218	$0.96
		Insurance	1%	$220,182	$0.80
		Fee	3.00%	$660,546	$2.41
		Phasing	5%	$1,100,910	$4.02
		Escalation	2.00%	$440,364	$1.61
		ESTIMATED CONTRACT VALUE		**$26,465,882**	**$96.59**
		Cost per space		**$33,459**	**791 Spaces**
Parking access and revenue control; ALLOWANCE **(Not included in Estimated Contract Value)**				**$400,000**	

SITE DEVELOPMENT SUMMARY

ELEMENT	
265600-Site Electrical	$303,460
26-ELECTRICAL	**$303,460**
311110 Clearing and Grub Site	$84,592
311410-Dewatering	$40,000
311610-Excavation Support and Protection	$37,160
312000-Earth Moving	$125,868
312500-Erosion and Sedimentation Controls	$59,761
31-EARTHWORK	**$347,381**
321216- Asphalt Paving	$122,930
321313-Concrete Paving	$41,746
321600-Curbing	$90,848
321700-Site Improvement	$5,560,161
323113-Fences and Gates	$65,000
329200-Turf and Grasses	$3,985
329300-Plants	$73,245
32-EXTERIOR IMPROVEMENT	**$5,957,915**
331100-Water Utility Distribution Piping	$70,000
333100-Sanitary Utility Sewerage System	$50,000
334100-Storm Utility Drainage System	$150,000
33-UTILITIES	**$270,000**
Subtotal	**$6,878,756**

SITE DEVELOPMENT

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
49	**02-EXISTING CONDITIONS**				
50					
51	**26-ELECTRICAL**				
52					
53	**265600-Site Electrical**				
54	Site electrical allowance including lighting	**1**	LS	$150,000.00	$150,000
55	Site lighting (assume 15 pole lights)	**15**	EA	$3,500.00	$52,500
56	Canopy lighting	**9,557**	SF	$5.00	$47,785
	Canopy lighting at High-level platform	**10,635**	SF	$5.00	$53,175
58	**265600-Site Electrical total**				$303,460
59					
60	**31-EARTHWORK**				
61					
62	**311110 Clearing and Grub Site**				
63	Site clearance allowance	**169,184**	SF	$0.50	$84,592
64	**311110 Clearing and Grub Site total**				$84,592
65					
66	**311410-Dewatering**				
67	Dewatering allowance	**1**	LS	$40,000.00	$40,000
68	**311410-Dewatering total**				$40,000
69					
70	**311610-Excavation Support and Protection**				
71	8' Construction fence, install & maintain	**2,296**	LF	$10.00	$22,960
72	Double construction Gate allowance	**2**	EA	$1,600.00	$3,200
73	Construct. entrance-gravel bed, construct and maintain	**2**	EA	$5,500.00	$11,000
74	**311610-Excavation Support and Protection total**				$37,160
75					
76	**312000-Earth Moving**				
77	Site cut & fill allowance	**892**	CY	$8.00	$7,137
78	Cut & fill of roadway, parking lot allowance	**3,546**	CY	$9.00	$31,913
79	Cut & fill of concrete sidewalk allowance	**241**	CY	$9.00	$2,173
80	New gas service for building - excavate trench only	**200**	LF	$50.00	$10,000
81	Gravel base to surfacing	**2,986**	CY	$25.00	$74,646
82	**312000-Earth Moving total**				$125,868
83					
84	**312500-Erosion and Sedimentation Controls**				
85	Hay bales and silt fence including maintenance allowance	**2,169**	LF	$4.50	$9,761
86	Storm water management plan	**1**	LS	$50,000.00	$50,000
87	**312500-Erosion and Sedimentation Controls total**				$59,761
88					

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
89					
90	**32-EXTERIOR IMPROVEMENT**				
91					
92	**321216- Asphalt Paving**				
93	Bit concrete pavement -parking lot	**12,527**	SF	$2.30	$28,812
94	Bit roadway pavement	**35,342**	SF	$2.45	$86,588
95	Parking stall painting, type.	**20**	EA	$35.00	$700
96	Painted cross walk allowance	**1,830**	SF	$1.00	$1,830
97	Misc. markings	**1**	LS	$5,000.00	$5,000
98	**321216- Asphalt Paving total**				$122,930
99					
100	**321313-Concrete Paving**				
101	Concrete sidewalk	**6,518**	SF	$5.00	$32,590
102	New ramp	**908**	SF	$7.00	$6,356
103	Curb cut allowance	**8**	EA	$350.00	$2,800
104	**321313-Concrete Paving total**				$41,746
105					
106	**321600-Curbing**				
107	Granite Curbing allowance	**2,672**	LF	$34.00	$90,848
108	**321600-Curbing total**				$90,848
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DAEDALUS
Salem MBTA Parking Garage
SITE DEVELOPMENT
Salem , MA

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
127					
128	**321700-Site Improvement**				
129	Canopy	**9,557**	SF	$135.00	$1,290,195
130	*Concrete full height platform*	***10,498***	*SF*		
131	Excavation to:				
132	New strip foundation excavation	**2,083**	CY	$8.00	$16,667
133	Excavation of slab on grade	**583**	CY	$9.00	$5,249
134	Gravel base to slab on grade	**355**	CY	$25.00	$8,875
135	Concrete to:				
136	Strip footings	**131**	CY	$150.00	$19,688
137	Foundation wall	**264**	CY	$150.00	$39,572
138	Slab on grade 5" thick allowance	**170**	CY	$130.00	$22,114
139	Reinforcing to:				
140	Strip footings	**10,500**	LBS	$1.05	$11,025
141	Foundation wall	**30,338**	LBS	$1.05	$31,855
142	Slab; w.w.f 15% allowance for laps	**12,073**	SF	$0.55	$6,640
143	Tactile warning strip	**457**	LF	$35.00	$15,995
144	Formwork to:				
145	Strip footings	**2,250**	SF	$7.00	$15,750
146	Foundation wall	**20,250**	SF	$8.00	$162,000
147	*Proposed high-level platform*	***10,635***	*SF*		
148	Canopy	**22,719**	SF	$135.00	$3,067,065
149	Excavation to:				
150	New strip foundation excavation	**2,930**	CY	$8.00	$23,437
151	Excavation of slab on grade	**591**	CY	$9.00	$5,318
152	Gravel base to slab on grade	**360**	CY	$25.00	$8,991
153	Concrete to:				
154	Strip footings	**246**	CY	$150.00	$36,913
155	Foundation wall	**453**	CY	$150.00	$68,013
156	Slab on grade 5" thick allowance	**172**	CY	$130.00	$22,402
157	Reinforcing to:				
158	Strip footings	**19,687**	LBS	$1.05	$20,671
159	Foundation wall	**52,143**	LBS	$1.05	$54,750
160	Slab; w.w.f 15% allowance for laps	**12,230**	SF	$0.55	$6,727
161					
162					
163					
164					

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
165					
166	Tactile warning strip	**782**	LF	$35.00	$27,370
167	Formwork to:				
168	Strip footings	**3,164**	SF	$7.00	$22,148
169	Foundation wall	**34,804**	SF	$8.00	$278,432
170	Railing at High-level platform	**292**	LF	$150.00	$43,800
171	Sheltd	**7**	SF	$10,000.00	$70,000
172	Bumpers	**1**	LS	$25,000.00	$25,000
173	Signage	**1**	LS	$5,000.00	$5,000
174	*Concrete ramp:*				
175	Excavation of slab on grade	**122**	CY	$9.00	$1,101
176	Gravel base to slab on grade	**84**	CY	$25.00	$2,099
177	Slab on grade 5" thick allowance	**40**	CY	$130.00	$5,230
178	Railing at concrete ramp	**262**	LF	$85.00	$22,270
179	Dumpster with enclosure allowance	**1**	EA	$1,600.00	$1,600
180	Dumpster pad allowance	**1**	LS	$1,200.00	$1,200
181	Equipment pad allowance	**1**	LS	$800.00	$800
182	Trash / Recycle Receptacles allowance	**4**	EA	$700.00	$2,800
183	60 foot high tapered anodized aluminum flagpole with	**1**	EA	$7,500.00	$7,500
184	internal halyard system and 8 foot by 12 foot flag.				
185	Bike rack and enclosure	**1**	AL	$20,000.00	$20,000
186	Benches allowance	**1**	AL	$14,400.00	$14,400
187	Bollards allowance	**12**	EA	$750.00	$9,000
188	Traffic signage allowance	**1**	LS	$5,500.00	$5,500
189	Building signs allowance	**1**	AL	$35,000.00	$35,000
190	**321700-Site Improvement total**				$5,560,161
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Salem MBTA Parking Garage
SITE DEVELOPMENT
Salem , MA

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
204					
205	**323113-Fences and Gates**				
206	Security gate	1	EA	$45,000.00	$45,000
207	Fence allowance	**1**	LS	$20,000.00	$20,000
208	**323113-Fences and Gates total**				$65,000
209					
210	**329200-Turf and Grasses**				
211	Lawn allowance	**8,529**	SF	$0.35	$2,985
212	Mulch allowance	**25**	CY	$40.00	$1,000
213	**329200-Turf and Grasses total**				$3,985
214					
215	**329300-Plants**				
216	Deciduous Trees	**8**	EA	$700.00	$5,600
217	Groundcover allowance	**8,529**	SF	$5.00	$42,645
218	Planting other than above allowance	**1**	LS	$25,000.00	$25,000
219	**329300-Plants total**				$73,245
220					
221					
222	**33-UTILITIES**				
223					
224	**331100-Water Utility Distribution Piping**				
225	Water utility distribution piping allowance	**1**	LS	$70,000.00	$70,000
226	**331100-Water Utility Distribution Piping total**				$70,000
227					
228	**333100-Sanitary Utility Sewerage System**				
229	Sanitary utility sewerage system allowance	**1**	LS	$50,000.00	$50,000
230	**333100-Sanitary Utility Sewerage System total**				$50,000
231					
232	**334100-Storm Utility Drainage System**				
233	Storm utility drainage system allowance	**1**	LS	$150,000.00	$150,000
234	**334100-Storm Utility Drainage System total**				$150,000
235					

ELEMENT	COST	COST/SF
02200-Earthwork	$310,315	$1.14
02-SITEWORK TOTAL	**$310,315**	**$1.14**
03 3000 Cast-in-Place Concrete	$1,805,204	$6.64
03 4100 Precast Structural Concrete	$6,509,775	$23.93
03-CONCRETE TOTAL	**$8,314,979**	**$30.57**
04 0510 Unit Masonry Assemblies	$752,214	$2.77
04-MASONRY TOTAL	**$752,214**	**$2.77**
05 1200 Structural Steel	$35,750	$0.13
05 3123 Metal Roof Decking	$10,010	$0.04
05 5000 Metal Fabrications	$202,690	$0.75
05-METALS TOTAL	**$248,450**	**$0.78**
07 1326 Self-Adhering Sheet Waterproofing	$7,617	$0.03
07 1613 Polymer Modified-Cement Waterproofing	$3,000	$0.01
07 4243 Composite Wall Panels	$0	$0.00
07 5419 Polyvinyl-Chloride (PVC) Roofing	$30,745	$0.11
07-THERMAL & MOISTURE PROTECTION TOTAL	**$41,362**	**$0.15**
08 1113 Hollow metal doors and frames	$9,000	$0.03
08 3613.13 Alum.-Framed Entrances & Storefronts	$218,820	$0.80
08 7111- Door Hardware	$5,400	$0.02
08-DOORS & WINDOWS TOTAL	**$233,220**	**$0.86**
09 3000 Tiling	$18,818	$0.07
09 9100 Painting	$75,316	$0.28
09-FINISHES TOTAL	**$94,134**	**$0.35**
10 1400-Signage	$95,200	$0.35
10 2801 Toilet and Bath Accessories	$1,000	$0.00
10 4406 Fire Extinguishers and Cabinets	$1,800	$0.01
10-SPECIALTIES TOTAL	**$98,000**	**$0.36**
11 1500-Parking Control Equipment	NIC	
11-EQUIPMENT TOTAL	**$0**	**$0.00**

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BUILDING SUMMARY

Salem MBTA Parking Garage
Salem , MA
272,000 GSF

ELEMENT	COST	COST/SF
14 2400- Traction Elevator	$240,000	$0.88
14-CONVEYING SYSTEMS TOTAL	**$240,000**	**$0.88**
21 0001-Fire Protection	$305,918	$1.12
22 0001-Plumbing	$337,200	$1.24
23 0001-HVAC	$20,000	$0.07
MECHANICAL TOTAL	**$663,118**	**$2.44**
26 0001 Electrical	$1,642,000	$6.04
26-ELECTRICAL TOTAL	**$1,642,000**	**$6.04**
Subtotal Carried to Main Summary	**$12,637,793**	$46.46

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
8	**02-BUILDING SITEWORK**				
9					
10	**02200-Earthwork**				
11	Rough grade for slab on grade	**58,497**	SF	$0.70	$40,948
12	New foundation excavation	**3,364**	CY	$11.00	$37,004
13	Backfill, using imported clean fill	**1,223**	CY	$24.00	$29,353
14	Disposal off site	**3,364**	CY	$18.00	$60,552
15	Elevator pit excavation	**1**	EA	$3,800.00	$3,800
16	Perimeter foundation drainage allowance	**1,220**	LF	$15.00	$18,299
17	Crushed stone base to slab	**1,512**	CY	$30.00	$45,360
18	De-watering	**1**	LS	$25,000.00	$25,000
19	Earthwork support	**1**	LS	$50,000.00	$50,000
20	**02200-Earthwork total**				$310,315
21					
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AEDALUS
Salem MBTA Parking Garage
Salem , MA
272,000 GSF

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
46					
47	**03-CONCRETE**				
48					
49	**03 3000 Cast-in-Place Concrete**				
50	Concrete to:				
51	Grade beams	**752**	CY	$185.00	$139,120
52	Pile caps	**210**	CY	$185.00	$38,850
53	Structured Slab on grade 6" thick allowance	**1,077**	CY	$185.00	$199,245
54	Ramp, assume 6" thickness allowance	**111**	CY	$185.00	$20,556
55	Reinforcing to:				
56	Grade beams	**139,120**	LBS	$1.05	$146,076
57	Pile caps	**31,500**	LBS	$1.05	$33,075
58	Structured Slab on grade 6" thick allowance	**161,550**	LBS	$1.05	$169,628
59	Ramp, assume 6" thickness allowance	**16,667**	LBS	$1.05	$17,500
60	Formwork:				
61	Grade beams	**10,156**	SF	$10.00	$101,560
62	Pile caps	**3,780**	SF	$10.00	$37,800
63	Structured Slab on grade 6" thick allowance	**5,399**	SF	$10.00	$53,990
64	Concrete beam at ramp	**576**	SF	$13.00	$7,488
65	Miscellaneous:				
66	Piles	**55,392**	SF	$12.00	$664,704
67	Sealed concrete floor, slab on grade allowance	**55,392**	SF	$0.50	$27,696
68	Vapor barrier	**55,392**	SF	$1.00	$55,392
69	Slab isolation joints	**3,545**	LF	$5.00	$17,725
70	Expansion joint at ramp	**128**	LF	$100.00	$12,800
71	Elevator pit mat walls and slab	**1**	LS	$7,000.00	$7,000
72	Keyway and waterstops	**1**	LS	$5,000.00	$5,000
73	Casting in accessories	**1**	LS	$20,000.00	$20,000
74	Winter working premium	**1**	LS	$30,000.00	$30,000
75	**03 3000 Cast-in-Place Concrete total**				$1,805,204
76					
77	**03 4100 Precast Structural Concrete**				
78	Precast structural included doublet tee beams & column	**216,554**	SF	$27.00	$5,846,958
79	($/SF Number provided by Walker)				
80	Traffic topping	**4,000**	SF	$3.50	$14,000
81	Penetrating silane sealer	**216,554**	SF	$0.50	$108,277
82	Architectural precast concrete panel	**12,870**	SF	$42.00	$540,540
83	**03 4100 Precast Structural Concrete total**				$6,509,775
84					

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
85					
86	**04-MASONRY**				
87					
88	**04 0510 Unit Masonry Assemblies**				
89	Scaffolding	**10,658**	SF	$2.00	$21,316
90	12" CMU wall @ lower level	**2,184**	SF	$20.00	$43,680
91	8" CMU wall @ lower level	**3,633**	SF	$18.00	$65,394
92	12" CMU at Elevator shaft wall	**2,393**	SF	$20.00	$47,864
93	12" CMU at stair	**2,448**	SF	$20.00	$48,960
94	Brick	**15,000**	SF	$35.00	$525,000
95	**04 0510 Unit Masonry Assemblies total**				$752,214
96					
97					
98	**05-METALS**				
99					
100	**05 1200 Structural Steel**				
101	Structural steel for roof - at 10 lbs / sq. ft	**14.3**	TON	$2,500.00	$35,750
102	**05 1200 Structural Steel total**				$35,750
103					
104	**05 3123 Metal Roof Decking**				
105	Metal deck for roof	**2,860**	SF	$3.50	$10,010
106	**05 3123 Metal Roof Decking total**				$10,010
107					
108	**05 5000 Metal Fabrications**				
109	Elevator pit ladder and sill angles	**1**	SET	$2,250.00	$2,250
110	Metal guardrail and support at ramp	**468**	LF	$80.00	$37,440
111	Pipe bollards allowance	**16**	EA	$400.00	$6,400
112	Impact protection barriers allowance	**500**	LF	$70.00	$35,000
113	Metal staircases with wall mounted handrails and balustrades	**12**	FLTS	$9,300.00	$111,600
114	Misc metals not identified above	**2**	TNS	$5,000.00	$10,000
115	**05 5000 Metal Fabrications total**				$202,690
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AEDALUS
Salem MBTA Parking Garage
Salem , MA
272,000 GSF

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
124					
125	**07-THERMAL AND MOISTURE PROTECTION**				
126					
127	**07 1326 Self-Adhering Sheet Waterproofing**				
128	Dampproof foundations	**5,078**	SF	$1.50	$7,617
129	**07 1326 Self-Adhering Sheet Waterproofing total**				$7,617
130					
131	**07 1613 Polymer Modified-Cement Waterproofing**				
132	Crystalline waterproofing to elevator pits	**1**	EA	$3,000.00	$3,000
133	**07 1613 Polymer Modified-Cement Waterproofing total**				$3,000
134					
135	**07 4243 Composite Wall Panels**				
136	Included in storefront price		SF		$0
137	**07 4243 Composite Wall Panels total**				
138					
139	**07 5419 Polyvinyl-Chloride (PVC) Roofing**				
140	PVC Roof, densdeck, insulation	**2,860**	SF	$10.75	$30,745
141	**07 5419 Polyvinyl-Chloride (PVC) Roofing total**				$30,745
142					
143					
144	**08-DOORS AND WINDOWS**				
145					
146	**08 1113 Hollow metal doors and frames**				
147	Single metal door & frames	**5**	EA	$1,000.00	$5,000
148	Double metal door & frames	**2**	PR	$2,000.00	$4,000
149	**08 1113 Hollow metal doors and frames total**				$9,000
150					
151	**08 3613.13 Alum.-Framed Entrances & Storefronts**				
152	Aluminum panel / storefront system	**2,646**	SF	$70.00	$185,220
153	Entrance or vestibule doors, glazed single	**4**	PR	$7,000.00	$28,000
154	Premium for electric operation	**2**	EA	$2,800.00	$5,600
155	**08 3613.13 Alum.-Framed Entrances & Storefronts total**				$218,820
156					
157	**08 7111- Door Hardware**				
158	Hardware sets, average cost	**9**	SETS	$600.00	$5,400
159	**08 7111- Door Hardware total**				$5,400
160					
161					
162					

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
163					
164	**09-FINISHES**				
165					
166	**09 3000 Tiling**				
167	Tile floors	**200**	SF	$15.00	$3,000
168	Ceramic wall tile	**954**	SF	$15.00	$14,310
169	Ceramic tile base	**106**	LF	$13.00	$1,378
170	Granite thresholds	**2**	EA	$65.00	$130
171	**09 3000 Tiling total**				$18,818
172					
173	**09 9100 Painting**				
174	Paint CMU walls	**14,004**	SF	$1.50	$21,006
175	Paint door and frame	**9**	LEAF	$105.00	$945
176	Parking stall painting, type.	**774**	EA	$35.00	$27,090
177	Parking stall -accessible	**17**	EA	$75.00	$1,275
178	Msic pavement painting	**1**	LS	$15,000.00	$15,000
179	Painting metal surfaces (stairs, handrails etc)	**1**	LS	$10,000.00	$10,000
180	**09 9100 Painting total**				$75,316
181					
182					
183	**10-SPECIALTIES**				
184					
185	**10 1400-Signage**				
186	Signage required by code	**272,000**	SF	$0.35	$95,200
187	**10 1400-Signage total**				$95,200
188					
189	**10 2801 Toilet and Bath Accessories**				
190	Toilet accessories allowance	**1**	LS	$1,000.00	$1,000
191	**10 2801 Toilet and Bath Accessories total**				$1,000
192					
193	**10 4406 Fire Extinguishers and Cabinets**				
194	Fire extinguishers,	**4**	EA	$450.00	$1,800
195	**10 4406 Fire Extinguishers and Cabinets total**				$1,800
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AEDALUS
Salem MBTA Parking Garage
Salem , MA
272,000 GSF

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
202					
203	**11- EQUIPMENT**				
204					
205	**11 1500-Parking Control Equipment**				
206	Parking access and revenue control				NIC
207	**11 1500-Parking Control Equipment total**				NIC
208					
209	**14-CONVEYING SYSTEM**				
210					
211	**14 2400- Traction Elevator**				
212	Hydraulic elevator, 4 stop, 3500 Lb.	**2**	EA	$120,000	$240,000
213	**14 2400- Traction Elevator total**				$240,000
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	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
241					
242	**15-MECHANICAL**				
243					
244	**21 0001-Fire Protection**				
245	Sprinkler Coverage	**55,392**	SF	$4.00	$221,568
246	Dry Alarm Valve w/compressor	**-**	EA	N/A	$0
247	Fire Dept. Connections	**2**	EA	$2,500.00	$5,000
248	FDV w/ 6" standpipe (two standpipes)	**10**	EA	$1,500.00	$15,000
249	Main piping:				
250	- 6"	**700**	LF	$85.00	$59,500
251	Coring, Sleeves & sleeves	**1**	LS	$1,250.00	$1,250
252	Lift	**1**	LS	$1,000.00	$1,000
253	Permits & Fees	**1**	LS	$750.00	$750
254	Shop drawings/hydraulic calculations	**1**	LS	$1,850.00	$1,850
255	**21 0001-Fire Protection total**				$305,918
256					
257	**22 0001-Plumbing**				
258	Water Closet	**2**	EA	$3,900.00	$7,800
259	Lavatory	**2**	EA	$3,900.00	$7,800
260	Oily Water Separator	**1**	EA	$10,000.00	$10,000
261	Sand Seapartor	**1**	EA	$15,000.00	$15,000
262	Trench Drains	**1**	LS	$12,000.00	$12,000
263	Floor Drains (garage)	**60**	EA	$3,000.00	$180,000
264	Roof Drains	**20**	EA	$4,800.00	$96,000
265	Permits & Fees	**1**	EA	$2,000.00	$2,000
266	Test and sterilize	**1**	EA	$2,100.00	$2,100
267	Shop drawings	**1**	EA	$4,500.00	$4,500
268	**22 0001-Plumbing total**				$337,200
269					
270	**23 0001-HVAC**				
271	Exhaust for basement	**1**	LS	$20,000.00	$20,000
272	**23 0001-HVAC total**				$20,000
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AEDALUS
Salem MBTA Parking Garage
Salem , MA
272,000 GSF

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
280					
281	**16-ELECTRICAL**				
282					
283	**26 0001 Electrical**				
284	Allow for "Plug-In" Electric cars	**4**	LOC	$2,500.00	$10,000
285	Electrical allowance	**272,000**	SF	$6.00	$1,632,000
286	**26 0001 Electrical total**				$1,642,000
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Annual Maintenance Cost
New Facility (Design Development Level Service Life Cost Study)

Project	Frame System	Date	Cars	SF
Salem MBTA - Salem , MA	Pre-tensioned Precast Concrete	3-Sep-10	800	361,000

Item Description	Unit	Quantity	Unit Price	Total Cost	Time Interval	No. Intervals	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	NPV (2010) 6%	$/car/YR 2010 $	$/SF/YR 2010 $
Inflation Factor (3% per Year)							0%	3%	6%	9%	12%	15%	18%	21%	24%	27%	30%	33%	36%	39%	42%	45%	48%	51%	54%	57%			
Preventive Maintenance																													
Replace Tee Sealants	LF	30,000	$ 10.00	$ 300,000	10	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$381,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$471,000	$ 359,608	$ 37.50	$ 0.08
Replace Architectural Sealants	LF	4,500	$ 12.00	$ 54,000	10	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$68,580	$0	$0	$0	$0	$0	$0	$0	$0	$0	$84,780	$ 64,730	$ 6.75	$ 0.02
Replace Expanson Joints	LF	370	$ 120.00	$ 44,000	10	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$55,880	$0	$0	$0	$0	$0	$0	$0	$0	$0	$69,080	$ 52,743	$ 5.50	$ 0.01
Re-apply Penetrating Sealer	SF	265,000	$ 0.50	$ 133,000	5	4	$0	$0	$0	$0	$148,960	$0	$0	$0	$0	$168,910	$0	$0	$0	$0	$188,860	$0	$0	$0	$0	$208,810	$ 349,543	$ 33.25	$ 0.07
Re-apply Traffic Topping	SF	800	$ 4.00	$ 3,000	15	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,710	$ 1,469	$ 0.25	$ 0.00
Replace Protected Membrane	SF	2,200	$ 40.00	$ 88,000	20	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$138,160	$ 43,079	$ 5.50	$ 0.01
Supplemental Drains & Piping	EA	-	$ 2,250.00	$ -	25	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ -	$ -	$ -
Miscellaneous	EA	-	$ 1.00	$ -	1	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ -	$ -	$ -
Subtotal																											**$ 871,171**	**$ 88.75**	**$ 0.20**
Routine Maintenance																													
Maintain Joint Sealants	LF	300	$ 10.00	$ 3,000	2	9	$0	$3,090	$0	$3,270	$0	$3,450	$0	$3,630	$0	$0	$0	$3,990	$0	$4,170	$0	$4,350	$0	$4,530	$0	$0	$ 17,177	$ 1.88	$ 0.00
Maintain Arch Sealants	LF	45	$ 12.00	$ 1,000	2	9	$0	$1,030	$0	$1,090	$0	$1,150	$0	$1,210	$0	$0	$0	$1,330	$0	$1,390	$0	$1,450	$0	$1,510	$0	$0	$ 5,726	$ 0.63	$ 0.00
Maintain Traffic Topping	LF	-	$ 3.00	$ -	5	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ -	$ -	$ -
Interim Beam & Column Patching	SF	-	$ -	$ -	1	20	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$ -	$ -	$ -
Maintain Drainage System	EA	1	$ 5,000	$ 5,000	1	20	$5,000	$5,150	$5,300	$5,450	$5,600	$5,750	$5,900	$6,050	$6,200	$6,350	$6,500	$6,650	$6,800	$6,950	$7,100	$7,250	$7,400	$7,550	$7,700	$7,850	70,434	$	$ 6.25
Maintain Lighting	EA	1	$ 5,000	$ 5,000	1	20	$5,000	$5,150	$5,300	$5,450	$5,600	$5,750	$5,900	$6,050	$6,200	$6,350	$6,500	$6,650	$6,800	$6,950	$7,100	$7,250	$7,400	$7,550	$7,700	$7,850	$ 70,434	$ 6.25	$ 0.01
Maintain Parking/Revenue Control	EA	1	$ 5,000	$ 5,000	1	20	$5,000	$5,150	$5,300	$5,450	$5,600	$5,750	$5,900	$6,050	$6,200	$6,350	$6,500	$6,650	$6,800	$6,950	$7,100	$7,250	$7,400	$7,550	$7,700	$7,850	$ 70,434	$ 6.25	$ 0.01
Inspections	EA	1	$ 7,000	$ 7,000	3	6	$0	$0	$7,420	$0	$0	$8,050	$0	$0	$8,680	$0	$0	$9,310	$0	$0	$9,940	$0	$0	$10,570	$0	$0	$ 29,520	$ 2.92	$ 0.01
Maintain Elevators	EA	2	$ 12,000	$ 24,000	1	20	$24,000	$24,720	$25,440	$26,160	$26,880	$27,600	$28,320	$29,040	$29,760	$30,480	$31,200	$31,920	$32,640	$33,360	$34,080	$34,800	$35,520	$36,240	$36,960	$37,680	$ 338,084	$ 30.00	$ 0.07
Painting	EA	1	$ 5,000	$ 5,000	1	20	$5,000	$5,150	$5,300	$5,450	$5,600	$5,750	$5,900	$6,050	$6,200	$6,350	$6,500	$6,650	$6,800	$6,950	$7,100	$7,250	$7,400	$7,550	$7,700	$7,850	$ 70,434	6.25	$
Maintain HVAC (station)	EA	1	$ 5,000	$ 5,000	1	20	$5,000	$5,150	$5,300	$5,450	$5,600	$5,750	$5,900	$6,050	$6,200	$6,350	$6,500	$6,650	$6,800	$6,950	$7,100	$7,250	$7,400	$7,550	$7,700	$7,850	$ 70,434	$ 6.25	
Subtotal																											**$ 742,677**	**$ 66.68**	**$ 0.15**
Average Annual Maintenance Cost																												**$ 155.43**	**$ 0.34**
Replacement Maintenance																													
Replace Drainage System	SF	361,000	$ 0.75	$ 271,000	25																							$ 338.75	$ 0.75
Replace Lighting System	SF	361,000	$ 1.75	$ 632,000	25																							$ 790.00	$ 1.75
Replace Parking Revenue Control	Lane	7	$ 50,000	$ 350,000	10		0	0	0	0	0	0	0	0	0	350,000	-	-	-	-	-	-	-	-	-	350,000	$ 304,570	$ 437.50	$ 0.9
Replace Signage	EA	1	$ 50,000	$ 50,000	25																							$ 62.50	$ 0.14
Replace Elevators	EA	2	$ 200,000	$ 400,000	25																							$ 500.00	$ 1.11
Miscellaneous	EA			-																									
Subtotal:																											**$ 304,570**		
Average Replacement Maintenance Cost																												**$ 2,128.75**	**$ 4.72**
Total Maintenance Costs:																												**$ 2,284.18**	**$ 5.06**
Total Net Present Value for 20 yrs of Maintenance																											**$**	**1,918,418**	

Notes:

The cost of routine house keeping and/or maintenace is not included.

Replacement Maintenance costs with intervals over 20 years are not included in price but are provided for information.